ARMOUR ENGINEER

AND ALUMNUS

OCTOBER, 1940

G-E Campus News

SUICIDE LAMPS

DID you ever take up a newspaper and read that someone committed suicide by jumping off a bridge? That's what high-intensity street lamps have been doing, too—not jumping off bridges, but committing "suicide."

Certain smooth-surface street-light reflectors reflect heat back to the lamp filament, thus raising the filament temperature to the point of early "suicide" or burnout.

In an attempt to do something about this, G-E engineers developed the stepped reflector. The inner surface of the reflector is broken up into small steps in such a way that light and heat rays reflected back from the steps just miss the vital lamp stem. Tests showed that, with a 500-watt lamp, the temperature at the lamp stem was 275 F less with the new reflector than with the old one.

The engineers who developed the stepped reflector are graduates of the General Electric Test Course, open to selected graduates of recognized engineering schools.

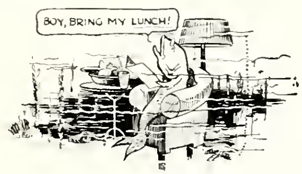
CHASING SHADOWS

HOW would you like to see carbon dioxide pour out of a beaker and snuff out the flame of a candle, or cold water from floating ice flow to the bottom of a glass? By accident two General Electric scientists recently discovered a comparatively simple way to force these and other ordinarily invisible things to show themselves.

It all began one day when a searchlight shining through the windows of the G-E Research Laboratory at Schenectady, N. Y. started the scientists on an investigation, resulting in equipment which gives the inside story of supposedly invisible happenings.

By holding transparent substances in a beam of light from a water-cooled mercury lamp, variations caused by changes in the index of refraction show up plainly on a screen. It's something like seeing heat waves rise from a hot pavement in the summer. Gases, liquids, or transparent solids cast strange shadows, revealing characteristics unseen to the naked eye. Although this has been done before with arc lights, the new method has many advantages.

The two G-E scientists identified with this accomplishment are Dr. R. P. Johnson, U. of Richmond, '29, and Dr. N. T. Gordon, Princeton, '13.



PISCATORIAL UTOPIA

INSECT laboratories have been air conditioned, rivets for dirigibles have been refrigerated so they can be driven better, and there is even a case where telephone books have been cooled mechanically to speed the hardening of the glue. But it was only recently that the first automatic heating installation designed specifically for the comfort and health of tropical fish was put into operation.

Devilfish, sharks, rays, the only porpoises in captivity, and thousands of other unusual specimens caper gaily around in their adopted home in the Marine Studios at Marineland, Fla. There, in huge tanks, the pampered fish live the "life of Reilly" (the porpoises are fed by hand) in water that is not only filtered and aerated but is also held at a temperature of 70 F.

Five General Electric oil furnaces do the heating job, holding the 500,000-gallon "oceanarium" at a temperature just like home for the transplanted tropical specimens.

At G.E.'s Bloomfield (N. J.) plant, where air conditioning equipment is manufactured, is a division of the General Electric Test Course. Here young student engineers gain practical experience in this branch of engineering.

GENERAL ELECTRIC

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ALVAH SMALL is President of Underwriters Laboratories, Inc., and President of the National Fire Protection Association. He graduated from the University of Maine with the degree of Bachelor of Science in Civil Engineering, and later received from the same school the professional degree of Civil Engineer. After graduation he became a member of a selected group of young engineers who were employed by the New York Fire Insurance Exchange for special training in fire protection engineering and in insurance rating. In 1906 he became an electrical engineer at Underwriters Laboratories, and has remained with that organization for thirty-four years. In 1908, he was made special agent and placed in charge of the Laboratories' inspectors; in 1910, he was made superintendent of Label Service, the department which conducts follow-up service at factories and supervises the use of the well-known Laboratories' label. In 1916, Mr. Small was elected vice-president; in 1923, he was transferred to New York to supervise the work of the Laboratories there, and at about the same time he was elected chairman of the important electrical committee of the National Fire Protection Association. He was elected president of Underwriters' Laboratories in 1935, and president of the National Fire Protection Association in 1940. Although he has had widely varied experience in fire protection engineering, it may be considerd that no part of his work has been more important than the progressive development, through his committee chairmanship noted above, of the National Electrical Code, which is now a standard of the American Standards Association. There are few engineering standards more widely used, or more important to the community. The importance of Mr. Small's work as president of Underwriters' Laboratories, Inc., is indicated by the article in this issue.

CHARLES AUSTIN TIBBALS is Dean of Armour College of Engineering.

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FIRE PROTECTION AND PREVENTION

A PHASE IN PREPAREDNESS

By

ALVAH SMALL

Moffett Studio

In these troubled times National Defense is in everyone's thoughts, and ways and means of assuring individual and collective safety get first consideration.

A part of national preparedness for the present emergency—a part, I dare say, as important as the mustering of men under the draft—is the conservation of national resources, the national wealth; for our resources are the foundation of all production accomplishment.

Right now America is being geared for maximum production of the required goods. Avoidable wastage of raw materials, finished products or facilities under the conditions is criminal from whatever viewpoint.

Each year preventable fire causes hundreds of millions of dollars of property loss and accompanying loss of thousands of lives: a drain on national resources and assets. Fire prevention and national defense are therefore closely tied together. At this time when economy and vigilance can contribute so significantly to the common effort for increased production, it becomes the patriotic duty of each person, each organization, to put an end to preventable waste by fire.

It is now appropriate, therefore, to review in brief some of the activities carried on in the normal course of events by the several fire prevention agencies in the United States. Daily they are being heightened, multiplied. New problems as well as old ones are constantly arising. An understanding of some of them will serve to inspire increased individual caution and watchfulness against the fire danger.

All are familiar at least with the names of the country's leading fire prevention agencies: The National Board of Fire Underwriters, the National Fire Protection Association, The Chamber of Commerce of the United States, and the National Fire Waste Council. Major campaigns against destruction by fire are continuously being waged by these organizations and others and by the fire prevention bureaus of our municipal fire departments. These groups work in many ways and in various fields, supplementing and complementing each other's efforts.

The Insurance Department of the Chamber of Commerce of the United States and the National Fire Waste Council suggest and foster practical fire prevention programs for local Chambers of Commerce, and sponsor the Inter-Chamber Fire Waste Contest. This is an activity in which many more people should participate in their respective home communities.

The National Fire Protection Association, a non-profit organization, serves as the clearing house for a vast amount of information and advice on fire waste, fire protection, and fire prevention. It prepares engineering standards widely used as the basis of state and municipal legislation and as guides to property owners who demand the maximum of fire safety, irrespective of legal or insurance requirements. The Association prepares and distributes educational literature to the public. Its quarterly magazine, received by members, contains much invaluable information. Membership is open to any individual or organization interested in the protection of life and property against loss by fire. I recommend it to you as being wholly worth while, whether

for a personal, commercial, civic, or national service.

There is no organization more keenly alive than the National Board of Fire Underwriters to the threat of the rising tide of the fire waste to national defense. The National Board, an insurance organization, is the national association of the capital stock fire insurance companies. During World War No. I all of its services, resources, and facilities were placed at the disposal of the Federal Government for safeguarding cantonments, supply depots, hospitals, naval properties, munition factories, warehouses, terminals, and ship yards as well as public buildings and institutions.

Again, in May, 1939, the National Board offered these services to the government for use in any emergency arising from the war in Europe: World War No. II.

Already the National Board of Fire Underwriters is speeding up fire prevention work. New literature has been prepared, earlier releases have been modernized and revamped; all have been widely distributed to promote a national concern to prevent fire waste. To help avoid disasters which might involve heavy losses of life and property, it is promoting country-wide school and hospital inspection.

As a service to cities, the Board for many years has made extensive engineering surveys of municipal fire-fighting facilities, reporting findings and recommendations to the municipal authorities. In these reports particular attention is given to the conflagration or sweeping-fire hazard.

Because they are designed to spread with maximum speed, incendiary fires often result in serious loss of life and property. To reduce these losses by detecting such fires and by capture and conviction of arsonists, the National Board maintains a large staff of skilled arson investigators collaborating with federal and local authorities in all parts of the country. It should not tax your imaginations to realize the importance of such work in these times.

One other organization not yet mentioned—an organization sponsored by the National Board of Fire Underwriters—is that with which I am most closely connected and in whose accomplishments I take the greatest pride. It had its genesis about the time of the first Chicago World's Fair in 1893 when electricity, just emerging from the experimental stage, was being promoted for practical use in stores and offices; when the then new Bessemer process was making "sky-scrapers" possible; and when acetylene-gas lighting systems were coming into prominence.

At that time it became evident to insurance companies and others that additional knowledge about these new technical processes was necessary. Accordingly, groups established by the stock fire insurance companies in many cities began to study causes of fire and means for its control and extinguishment, and to adopt safety rules and regulations.

With continued development the need arose for extending the investigations to comprise study of the basic facts of fire behavior and of the performance of devices and materials as causes of fire, as safeguards against its spread, or as means for its control and extinguishment.

For these investigations specialists and facilities for experiment were necessary; this fact resulted in the establishment of Underwriters' Laboratories, Inc., and its incorporation in 1901 as the testing station of the capital stock fire and casualty insurance companies comprising the National Board of Fire Underwriters.

Under the sponsorship of the National Board, Underwriters' Laboratories was established as an organization for service, not for profit. Its job from the beginning has been to test devices, materials, and systems to determine their relation to an insurable hazard. Its platform is to

identical with their own—the viewpoint of avoiding loss.

From a small beginning in staff, equipment and scope, Underwriters' Laboratories has expanded in facilities and activities so that its work now touches upon a wide range of problems concerning the preservation of life and property by the reduction of fire, accident, and theft hazards.

This range of activities is indicated by the titles of the following Laboratories' publications which contain approximately 200,000 approved catalog numbers in some 1,500 classifications:

- List of Inspected Electrical Equipment
- List of Inspected Fire Protection Equipment and Materials
- List of Inspected Gas, Oil, and Miscellaneous Appliances
- List of Inspected Accident Hazard, Automotive and Burglary Protection Equipment

The listings in these booklets are affirmative. All of the devices and materials shown therein have passed the safety tests and investigations. The Laboratories does not publish negative findings or reports of criticism of products, except to the manufacturer concerned. The booklets are circulated widely so that the insurance organizations and other interested persons and organizations may benefit from the information they contain.

Approximately half of all of the original investigations result in reports of defective items of assembly or performance. Of those products refused approval the first time they are submitted by their manufacturers, about half are improved.

Underwriters' Laboratories works for service, not for profit. Charges are based on the fee-according-to-cost system. Manufacturers voluntarily submit their products and pay the costs of the tests and investigations. Neither insurance companies nor other manufacturers can be expected to pay the costs of examinations and tests of products which, poorly designed, are not put into production and which, therefore, are not used in insured or other premises.

The technical staff of Underwriters' Laboratories is divided into departments as follows:

- Protection
- Casualty and Automotive
- Gases and Oils
- Burglary Protection
- Electrical
- Hydraulic
- Chemical

In addition to these engineering departments which examine and test new equipment submitted for approval by manufacturers, the Labora-

Flame Spread Test on Roof Covering Material. Flame Is Four Feet Wide and Is Blown Against Surface by Twelve-Mile Wind

"state the facts" and the best obtainable opinions brought out by investigations and tests.

The concern of an insurance executive who may be a member of the Laboratories' board of trustees, as to the bearing of a Laboratories' finding upon the amount of a loss coincides exactly with the concern of an honest property holder in the matter. Therefore, knowing of the insurance sponsorship of Underwriters' Laboratories, Inc., the owner and user of premises, police and fire department officers, building officials, the architect and professional engineer, and the insurance man alike intuitively accept the findings as founded upon a viewpoint

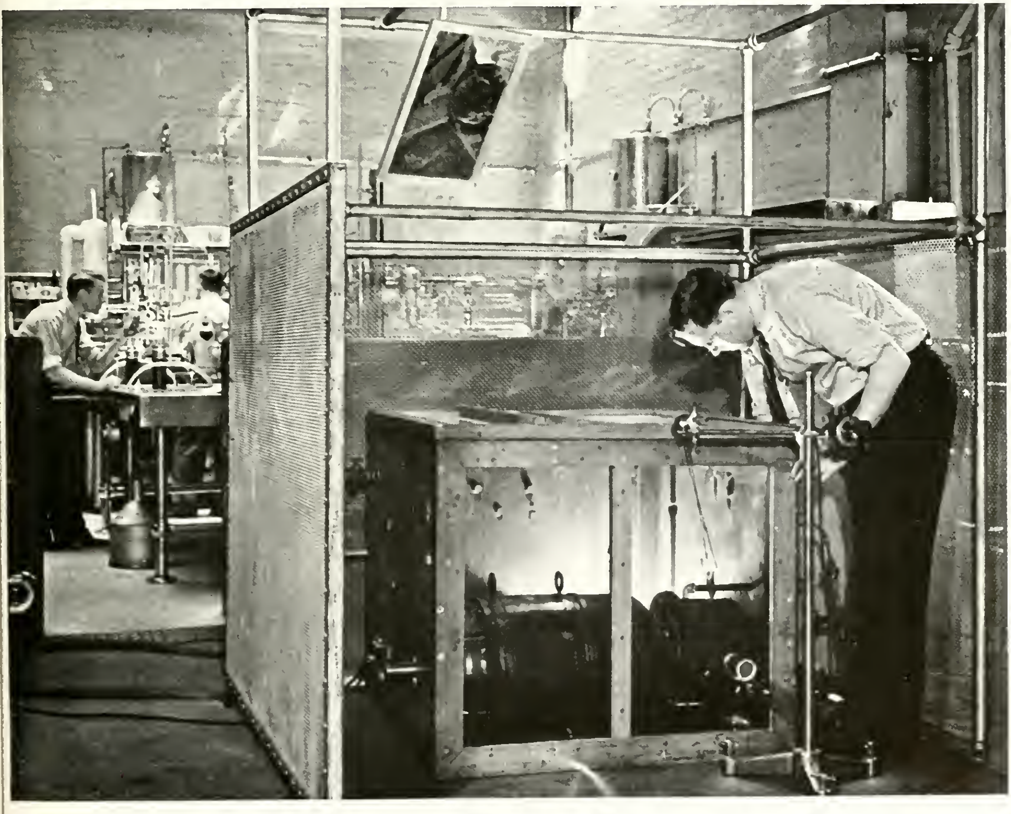
tories maintains an inspection department with offices in 200 cities in the United States and Canada. Any organization presuming to publish outstanding advices concerning the products of another must know at all times that the current output of those products remains such as to warrant public endorsement. Last year the Laboratories' inspectors made over 60,000 inspections at factories to help keep up the standard of safety. Products that pass inspection at factories are usually identifiable by means of the "Underwriters' Laboratories Inspected" labels attached to them.

The results of this work have been such that many purchasers and users and many authorities specify the Underwriters' Laboratories' label on all deliveries of products which come within the scope of this testing activity.

One of the most outstanding fire protection problems undertaken by Underwriters' Laboratories was the investigation of the behavior of building columns when exposed to fire. This research, extending over a four-year period, was conducted at the main office and principal testing station in Chicago. In this investigation the Laboratories collaborated with the National Bureau of Standards, the Associated Factory Mutual Fire Insurance Companies and the National Board of Fire Underwriters. Published reports of the findings are regularly consulted by building engineers and officials, architects and the producers of building materials. The fire exposure or temperature curve employed in that research is the basis for other fire tests of building materials tested at Underwriters' Laboratories. This curve makes it possible for actual burning building conditions to be produced in the laboratory so that the performance of building materials as fire barriers may be determined.

In its furnaces of various sizes and designs the Laboratories has tested for many manufacturers masonry units and other assemblies for floor, wall, roof and partition construction. Materials available for the confinement of fire to the space of its origin are classified as to the time interval before standard exposure in the furnaces produces breakdown. Thus an architect or engineer for a property owner, a building official, or an insur-

Tests of Explosion-Proof Electric Motors Designed for Use in the Presence of Combustion Vapors



Right: Test of Vaporizing-Liquid Type of Hand Chemical Extinguisher on Gasoline Fire

Below: Fire Test of Wired Glass Window with Metal Frame

ance organization, may select, install, or identify as to fire retarding performance, a schedule of assemblies providing protection from five minutes up to eight hours.

Fire doors and windows of many types have been tested and numerous makes and patterns are now approved and labeled. Safes, doors for vaults, and record cabinets have been classified according to the protection they will afford from fire's attack.

Approved automatic sprinklers have established an efficiency record of better than ninety-six per cent over a forty-three-year period. This record was possible because of the testing program to which these devices are subject as a requisite for approval by the Underwriters, and of the persistent checking and gauging by the Laboratories' inspectors of the day's run production at each factory.

Fire hose is examined for rubber compound used as the lining with which the water comes in contact, for the woven cotton jacket and for test performance of complete assemblies. Service requirements as to twist, elongation, warping, friction loss, and the ability to withstand higher than normal internal pressures without bursting, are also checked.

Underwriters' Laboratories inspects at factories each fifty-foot length of an average annual delivery of more than 400 miles of hose for municipal fire department use.

Each year's models of pasenger automobiles of practically all domestic makes are submitted to Underwriters' Laboratories for investigation of the fuel, ignition and exhaust systems. This work is done largely at the factories when the new models are being designed. Fire causes are therefore mainly avoided before the production line is reached. As a result of this work the integral fire hazard is practically ignored in passenger car underwriting. The car owner, whether insured or not, is a beneficiary of this special service.

The casualty department of the Laboratories tests practically all makes of domestic automatic refrigeration equipment and also investigates air conditioning equipment, water coolers, and coin-operated soft-drink dispensing machines.

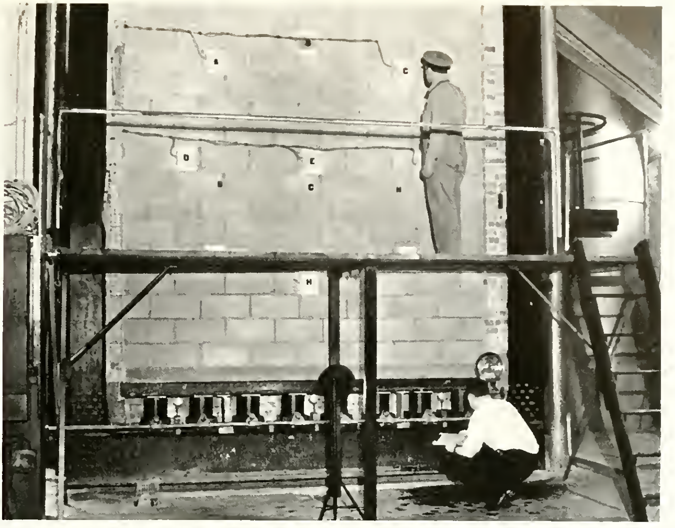
The gases and oils department has examined and tested, and labels, oil burners for approximately 200 manufacturers. The entire range of hand fire extinguishers also comes within their scope of testing and although some types, pressure operated, could endanger life and limb if not properly safeguarded, the general public with a confidence fully justified by their experience, grabs the fire extinguisher when needed and uses it without fear of personal injury.

Roadside filling stations for dispensing gasoline are safeguarded by a variety of tests. Underwriters Laboratories' labeled pumps and storage tanks and explosion-proof equipment are so universally used that fear of fire or explosion is entirely absent from the minds of most motorists.

The electrical department, with testing stations in New York City and San Francisco as well as at the main testing station in Chicago, conducts investigations of products used in the permanent wiring systems of buildings from the point at which the electricity enters to the wall outlets and switches. Also much of the current consuming electrical equipment used in the 25,000,000 electrified homes of this country, as well as mercantile and light industrial equipment is examined.

Fire alarm mechanisms and systems, and related signalling devices are reviewed and tested.

The chemical department is equipped with special apparatus for testing rubber insulation of insulated wires and cords and for tests of the linings of fire hose. Other problems considered have to do, for example,



Above: Fire and Load Test of Wall Made of Hollow Concrete Blocks

Below: Steel Safe About to Be Rolled into Test Furnace Preheated to 2000 Degrees

Test of an Electric Motor Designed for Use in Grain Elevators or Other Buildings Where the Atmosphere May Be Laden with Dust

with the saturants and weights of roofing felts and the weights of zinc coatings on electrical conduit. The work of this department in high explosives is outstanding. At an isolated test station outside of Chicago, tests are conducted with nitroglycerine and other high explosives and on containers for hazardous materials, the decomposition products of which are either flammable, explosive, toxic or perhaps all three. Work done here on cellulose products such as photographic film will, it is hoped, do much to avoid another disaster such as the Cleveland Clinic X-Ray film fire of 1929 in which some 124 persons, many of them out of the reach of the fire, died of the "green death."

The chemical department has pioneered the classification of explosion resisting motors and other electrical equipment for use in hazardous locations such as oil refineries, dry cleaning plants, paint factories and in locations where flammable dusts are encountered such as grain elevators, starch factories and the like.

Through the work of the burglary protection department the Laboratories serves the insurance industry and the banking and mercantile establishments in a field quite detached from that of fire prevention and fire protection. Basically, however, these activities have the same common purpose—that of determining the relation of devices, materials and systems to loss prevention and reporting thereon to consumers, regulatory officials and the insurance sponsors of the Laboratories.

In these ways and in many others Underwriters' Laboratories helps safeguard life and property on a hundred different fronts.

In another way too, Underwriters' Laboratories has been privileged to assist in reducing waste of life and property. It was our founder-president, I believe, who proposed that Armour Institute of Technology establish a course in fire protection engineering; and for many years the "Fire Protects" have received some of their laboratory training at Underwriter's Laboratories under the direction of an engineer on both the Laboratories' and the Armour staff. The graduates of Professor Finnegan's course are contributing to our national safety.

These are some of the activities and accomplishments of the professional fire prevention organizations. But in spite of all that is being accomplished these organizations cannot reach everyone with the message of safety. If the nation's fire waste is to be reduced people must be made conscious of the dangers of fire. *You* and others like you, can bring the artillery of facts about safety right down to the front line of the battle. In the interest of national defense enlist today in the battle against fire.

THE PART OF PLUMBING, IN PRESERVING WATER PURITY

By

JOEL I. CONNOLLY

Drinking water must be safe when delivered at the faucet or fountain jet. This is axiomatic. It makes no difference how carefully purified it may be at the source if contamination enters the water in the distributing system in the streets or in the plumbing systems of buildings. Much loss of life has occurred in epidemics of typhoid fever and other water-borne diseases. Some of the outbreaks have been due to pollution of water in the plumbing systems of buildings. The Health Department and Water Department of any city should properly be concerned about prevention of such occurrences, and in Chicago, both are officially responsible. Water piping is under supervision by the Water Pipe Extension Division of the Department of Public Works, and the rest of the plumbing is inspected by the Division of Educational and Environmental Sanitation of the Health Department.

Students in a school of engineering are interested in such matters because, after they have completed their studies, the public will intrust its lives and health to their engineering skill in many ways, and they must not fail in this trust. Unfortunately, lack of information, where health is concerned, on the part of the engineer, has in the past actually led to epidemics. For example, a connection, made innocently enough by a "handy man" working for a building engineer, between a drinking-water pipe and another pipe has, in this city and elsewhere, more than once has caused illness and even death. To mention a different sort of case, people living in regions previously free from malaria fever have become infected after roads or railroads were built in their vicinity, on account of failure on the part of the engineer to provide for drainage of borrow pits or of the upper parts of valleys and ravines crossed by fills. Anopheles mosquitoes have found such undrained places to be good breeding grounds. These are the mosquitoes that carry the disease from sick persons to well ones. Civil engineers should always bear in mind the possibility that even in the north, where malaria fever has not been prevalent for several generations, it has reappeared, as the result of creating new breeding places for mosquitoes while building engineering structures. This is true, for instance, along the upper Mississippi River at the present time, it is said, on account of new dams in the river.

How Water Contamination Occurs

There are two principal ways in which plumbing is a factor in making drinking water unsafe. They are:

1. Cross-connection of the safe supply of water with a contaminated supply under pressure which is (or may become) higher than the pressure of the safe supply, and

2. Interconnection of the safe water supply with fixtures or sewers not normally under pressure, but which may discharge their contents into the safe water supply if

(a) Pressure develops in the fixtures or sewers from unusual circumstances, (such as flooded street sewers), or

(b) A negative head develops in any water pipe, which has an opening submerged in the contents of fixtures, drains or sewers.

These cross-connections and interconnections have long been common, but epidemics from them occur only at intervals, because usually an additional condition must obtain, such as, for example, a leak in a check valve between two water systems, before the drinking water will become unsafe.

People who make dangerous cross-connections and inter-connections are usually either unacquainted with the hazards they create, or are willing to gamble with the lives of other people, on the chance that the extra condition needed to cause water pol-

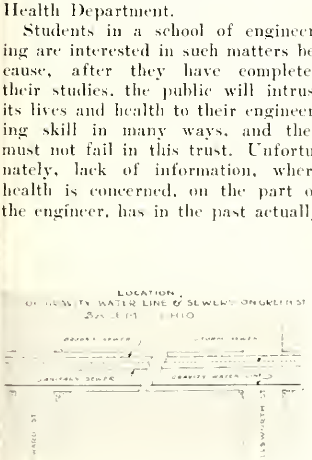


Fig. 1. Diagram of leaking sewer and defective gravity water main, by means of which the water became infected in the disastrous Salem, Ohio, typhoid fever outbreak.

Fig. 2. Collapse of hot water tank caused by partial vacuum in water pipe, such as was in pipes of East Lansing laboratory building when water infected with Brucellosis was siphoned from sink into water supply and thereby caused an epidemic among students.

Fig. 2

Fig. 3. Cross-connection of drinking water pipe with air washer in spray booth. Pressure of wash water, containing chemicals washed from spray booth air, may be raised by circulating pump in foreground to higher level than pressure of drinking water, thereby forcing chemicals, which may be very poisonous in character, through valve at right of picture (if not tightly closed), into the drinking water system. The other branch of the drinking water pipe is used to make up water lost by evaporation from the circulating water. It is an interconnection with its end submerged, which permits siphonage of chemicals into the drinking water when partial vacuum occurs in the drinking water system at this point.

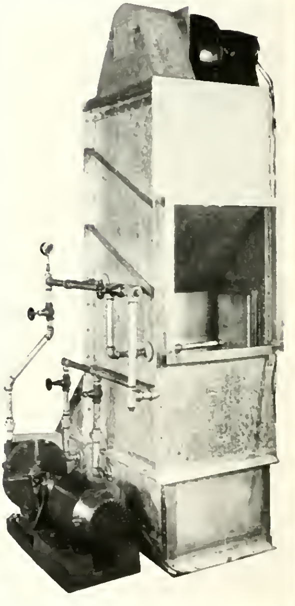


Fig. 3

Fig. 4. Leaking sewer pipe over drinking water cooling tank in hotel basement, to which beginning of amebic dysentery epidemic has been attributed. Wooden cover has been removed from tank. Strings hanging from sewer pipe indicate locations of leaks in it, through which sewage escaped when the sewer pipe became flooded due to excessive use of plumbing fixtures when hotel was crowded, and during times of storm.

Fig. 4

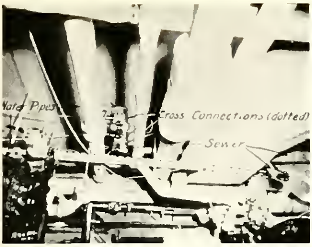


Fig. 5

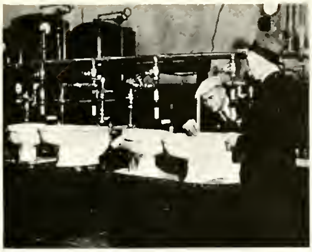


Fig. 6

Fig. 7

Fig. 5. Location of interconnections between sewer pipe and water pipes in basement of hotel, which were factors in the extension of the amebic dysentery epidemic to another hotel using the same water supply. Because the interconnections were removed before the photograph was made, their positions are shown by dotted lines. Failure to close tightly the valve on one or both of these interconnections permitted sewage to pass from the sewer pipe, when flooded, into the water pipes while the water pressure in the latter was lower than the head of sewage.

Fig. 6. Chief of Plumbing Section of Chicago Health Department, Mr. Thomas J. Claffy, supervising research by one of the plumbing inspectors of that section, Mr. John R. Thompson, on devices intended to prevent siphonage from water-closets. They are measuring and recording the lowering of the level of the water surface caused by partial vacuum in the water supply pipe, which siphoned part of the water in the water-closet back through the flush valve into the water pipe.

Fig. 7. Part of an educational exhibit by the Chicago Health Department at a medical society convention dealing with amebic dysentery and plumbing hazards to the safety of water supplies. Charts and map on walls give scientific data on the disease. Using the model of a hotel, demonstrations were given by use of colored liquids showing how water contamination through interconnections between water pipes and sewer pipes takes place. Also siphonage from plumbing fixtures was shown by use of this working model, which has been used for educational purposes in many parts of the country. Motion pictures of siphonage from plumbing fixtures and of living ameba as seen under the microscope were also shown in this exhibit and many others.

lution will not occur. The long list of epidemics in recent years from this cause is sufficient to convince every right-minded person that such gambling does not pay. People have too often put their faith in check valves which have failed to work when needed. Others have neglected the fundamentals of hydraulics and made such arrangements that flow of sewage into unprotected sources of water supply or into water mains became inevitable, with resultant epidemics and loss of life.

Recent Interesting Water-borne Disease Epidemics

Among the scores of recent important water-borne disease epidemics, four of especial interest to the engineer have been selected for purposes of illustration:

1. The Salem, Ohio, typhoid fever epidemic[1] was one of the most severe on record, striking down more than one-twelfth of the entire population of that city and requiring the aid of doctors and nurses from other places to treat and care for the victims. In this disastrous outbreak, 884 people were made sick in a population of 10,300 in the city, and 27 of them died. As we look back at the situation, it seems remarkable that the epidemic did not occur sooner. A sewer having leaking joints permitted the bacteria which are always present in sewage to escape into the ground. The sewer was paralleled by a nearby gravity water main, also in a leaky condition, which acted as a farm drain tile does in draining a marshy meadow. Ground water, containing micro-organisms from the sewer, found its way into the water main through crevices in the ground between the two pipes, these crevices acting as natural interconnections between them.

The epidemic resulted when a case or carrier of typhoid fever contributed fecal discharges to the sewage and the bacteria causing this disease were widely distributed among the people of the city via sewage in the sewer, ground water in the crevices of the soil, and public water supply in the gravity water pipe and its various branches.

2. Last year's Manteno, Illinois, outbreak resulting in sixty deaths was similar in some respects to the Salem epidemic. Here the wells from which the State hospital took its supply became contaminated, also through crevices in the rock, by sewage from the institution. This was shown by a rise in salinity of the well water shortly after quantities of rock salt were placed in the sewers, the amount of salinity increasing as more and more of the salt passed through the ground from sewers to wells. In this case the wells were farther from the sewers than was the gravity water pipe at Salem, but the character of the limestone rock at Manteno was such as to permit easy unobstructed flow of sewage to wells through numerous crevices and solution channels in the rock. Anyone who has ever visited Carlsbad Cavern, New Mexico, Mammoth Cave, Kentucky, or Luray Cavern, Virginia, can appreciate how large, at times, may be the channels dissolved in limestone rock by water. Although water filtering through fine sand may be purified within a short distance, the limestone gives no such protection to the health of those who drink the water. The control of the epidemic was greatly hampered by the mental condition of the hospital inmates.

A very interesting side-light on this epidemic is found in a statement, recently made in a lecture dealing with this epidemic, by Mr. Clarence W. Klassen, State Sanitary Engineer of Illinois, that many mental-disease victims, also suffering from typhoid fever, temporarily became rational during the height of the fever. Friends were able to hold conversations with them for the first time in years while they were running a high fever. Upon recovery from typhoid fever, the mental symptoms returned. This finding is in harmony with the effects known to be produced by "artificial fevers" in the treatment of victims of paresis due to brain syphilis.

A repercussion of this epidemic felt in Chicago is the illness of workmen from this city who were employed in construction of new buildings at the Manteno State Hospital and who returned to their homes here when they began to feel sick. A more unusual sequel is the release upon parole of typhoid carriers to return to Chicago when their mental condition improved. These carriers are constant dangers, because, although they have recovered their feeling of health, they still discharge typhoid bacilli with their feces and may start new epidemic foci wherever they go. In one such parolee, the mental disease has returned and has necessitated his recall to the hospital. The supervision of a typhoid carrier who may become deranged at any time constitutes a somewhat new problem for a city health department, which has had its troubles in controlling sane carriers.

3. The East Lansing, Michigan, epidemic of brucellosis (often called undulant fever),[2] also occurring last year, is a recent example of water-borne disease which is of special interest to students because college students were principally the victims, one of them losing his life in the outbreak. This epidemic has been attributed to siphonage of dish-water into the drinking-water supply in a laboratory of the Michigan State College where glassware was used in experiments with this disease, which affects both cattle and man. In an unsuccessful attempt to sterilize the glassware, it was insufficiently heated in an autoclave before washing. As the result, germs that should have been destroyed remained alive and got into the dish-water, which was drawn back through a hose connected to the sink faucet, into the domestic water supply of the building.

Only people who went into this building were affected by the disease. There were at least eighty victims, of which seventy-six were students. It seems probable that the suction into the water pipe was only momentary, when it occurred, as the disappearance of an appreciable quantity of dish water was not noticed at any time, but, short as it probably was, it lasted long enough to cause much illness and cost the life of a young man.

This occurrence serves to illustrate the reason why epidemics of water-borne disease occur intermittently rather than constantly. In order to get the dangerous contamination into the water pipes, three conditions had to coexist:

1. The micro-organisms causing brucellosis had to be present in the dish-water; this apparently occurred regularly, on account of the defective technic employed to sterilize the dishes.

2. The faucet to which the hose was attached had to leak or be at least partly open, and

3. The normally positive pressure at the faucet in the water pipe had to be changed to a negative head in order to suck the infective dish-water up through the hose and into the water-supply piping system.

Of course, the first two conditions mentioned might have been present most of the time, awaiting the moment when the third necessary condition would also develop and the epidemic would result.

Poison in Drinking Water

Although this discussion has been limited to outbreaks of disease of communicable character, i. e., those caused by bacteria or other micro-organisms and capable of spreading to a well person from a sick one or carrier of the disease, it should be borne in mind that poisonings by chemical substances have occurred in similar fashion. Sometimes these chemicals are detected by taste, odor or irritating effects before harm is done, but

one cannot afford to take the chance that this will always be true.

Not every case of contamination, however, is tragic. Newspapers recently carried an item about the water in an Illinois city which had a beer taste, due to an interconnection of a water pipe and a beer container in a brewery. A case is on record where water, in which horse manure was soaked to make liquid fertilizer for a greenhouse, was drawn (probably not as a thirst-quencher) in a saloon next door to the greenhouse, much to the amazement of customers and proprietor alike. The cause was found to be siphonage from a water pipe submerged in the manure tank, when a partial vacuum occurred briefly in the street main supplying both premises.

Recently, a plumbing inspector discovered a water inlet at the bottom of a tank containing potassium cyanide, one of the most poisonous chemicals known, in a silver-plating shop in a large office building. Had this not been found and immediately corrected, (as it was) before any such siphonage occurred as took place at East Lansing, a large number of the occupants of the building would unquestionably have been f a t a l l y poisoned. Similar submerged inlets in photographic and X-ray developing tanks were formerly common, but fortunately less acutely dangerous. Some types of toilets, bedpan washers, bathtubs, and many other fixtures may also have submerged inlets and must be properly safeguarded against siphonage.

When one realizes that a large office building or hotel may contain at one time as many people as a fair-sized town, and because of the continual coming and going of different people, in a year it may have within its doors enough people to populate a large city, the need of as competent engineering supervision of the design, construction and maintenance of the utilities, such as water supply and sewerage, in such buildings as in a town of equal population, at once becomes apparent. Actually, however, the large building often presents greater engineering problems, since, because of its height, the range of pressure variations in the water-supply system is greater than in a town consisting of low buildings, and the need of conserving valuable space in areas of high rents further complicates the problems of design and repair.

Added to this is the fact that in many cities the sewers in the downtown sections were built many years ago, at a time when present loads were not anticipated. This condition of outgrown sizes of sewers, together with the advent of air conditioning on a large scale with its accompanying discharge of considerable quantities of condenser water on warm days, has overloaded the sewers to a dangerous extent in many cities; this is sometimes a factor in causing epidemics, as will be more clearly brought out in the consideration of the fourth of the epidemics of special interest to the engineers.

The Chicago Amebic Dysentery Epidemic.[3]

Possibly the most widely known epidemic of water-borne origin of recent years occurred in Chicago in 1933. This epidemic of amebic dysentery occurred at the time of the first season of the Century of Progress Exposition, often called the second Chicago World's Fair. Two results of the investigation of this outbreak have been a new conception of the way in which amebic dysentery may spread and a new recognition of the important part that plumbing plays in the preservation of health and prevention of disease. The epidemic spread to all parts of the United States and Canada and to a slight extent across the ocean. The number of cases will probably never be even approximately known, because of the wide geographic distribution of the victims and the great difficulty of securing reliable reports from many people separated by such distances. However, the official report on the epidemic, written by a group of notable experts and published by the United States Public Health Service, makes mention of more than fourteen hundred cases and nearly one hundred deaths. Not all of these were proved to be from the same source, but in many cases full information was not available regarding possible contact with the common source.

This was the first time an epidemic of amebic dysentery in a civil population was proved to be water-borne. Previously it was generally accepted that infectious food was the medium of transmission par excellence. It was natural, therefore, that at first the efforts to halt the spread of the infection should be principally directed to the examination and control of food and food-handlers in the hotel from which the first cases were reported. When these efforts proved unavailing, other possibilities were intensively investigated and finally, after much careful detective work, the real vector of transmission found drinking water contaminated by sewage in the hotel.

A leaking sewer pipe directly over a cooling tank of drinking water became flooded with sewage, because of the crowded condition of the hotel incident to the arrival of an unusually large number of guests who came to visit the World's Fair, and also because of the undersized sewers available for carrying off the increased amount of sewage, particularly during storms. During the periods of flooding, sewage backed up in the leaking sewer pipe, forced its way out through the holes and dripped onto the wooden cover of the tank below and percolated through it, contaminating the drinking water within and spreading the disease to guests and employees in all parts of the hotel.

Placing a sewer pipe which is subject to heavy overloading directly above a drinking-water tank in this manner is faulty design, and an example of the neglect of the fundamentals of hydraulics which has frequently been instrumental in spreading disease. The danger from a leak in the sewer pipe inherent in such relative positions of sewer and water tank is evident.

With the coming of hot weather, an air conditioning plant in the hotel was placed in service from time to time, involving the occasional use of an interconnection between the air conditioning mechanism and a sewer pipe in the hotel basement for discharging surplus condenser water. The investigation indicated that failure to close tightly a valve on the interconnection permitted sewage to make its way into the pipe carrying condenser water, whenever the head of sewage in the sewer pipe on one side of the leaking valve exceeded the head of water in the water pipe on the other side. This sewer, also, was at a higher elevation than the condenser water pipe with which it was interconnected. Subsequent use of this condenser water, intermittently contaminated with sewage through the interconnection of water pipe with sewer pipe, further contributed to the spread of disease, both in the hotel of origin and in another hotel across the street served by the same water system.

Aftermath of the Epidemic

As soon as the true cause of the epidemic was discovered, immediate corrections of the responsible conditions were made. In addition, a revamping of the entire drainage system in the hotel was done, greatly increasing the size of sewers to relieve the surcharging and prevent backing up of sewage under peak loads in future. A large force of highly competent sanitary engineers and plumbing inspectors was employed at once to study all other

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PROCESS CONTROL THROUGH INSTRUMENTATION

By

HARRY McCORMACK

The Robots are invading industry. For the past decade this has been occurring quietly but persistently. In recent years the pace has accelerated until it has almost assumed the "blitzkrieg" stage.

These Robots have not been of the kind customarily depicted, a human form actuated by various mechanical devices enabling it to simulate human motions. They have been "gadgets" of multiple forms which would perform the functions of a human being in actuating the controls on some industrial process without in any way resembling the form of a human being nor simulating its motions.

The result has been the automatic control of many industrial processes which a few years past depended on intelligent human control for their proper functioning. A process of this same type which is well known and rather widely used is the automatic control for the domestic heater. It embodies several of the controls which are rather generally used and therefore presents many of the problems found in other similar industrial applications.

Assume that the control desired is that of temperature. The first question to be decided is: where should the control instruments be located? The dwelling consists of several rooms, more or less interconnected. Obviously control instruments intended to control the source of heat cannot be located in every room when there is only *one* source of heat. One method for controlling heat uses a control instrument in each room, connected to the radiator valve in that room. A constant supply of heat must be assumed.

The temperature at the control point is approximately that desired but the temperature in other parts of the room may deviate much or little from this value, depending on the movement of air within the room.

The temperature was stated to be approximately that desired because there must be some appreciable fluctuation in temperature to cause the opening or closing of the steam valve on the radiator. The general result is that most of the time the room temperature is either above or below that which is desired. The deviation is, in this instance, not a matter for serious consideration.

Comment on conditions influencing the temperature control of the room has been somewhat extended as similar characteristics are to be noted in all processes controlled through instrumentation.

The control is where the control instrument is located. The characteristic being controlled is, during the greater part of the time, not *exactly* at the control point. This was a serious fault in early designs of control instruments but has been nearly eliminated in present instruments.

One of the outstanding instruments securing closer control of desired conditions is the Micromax controller, developed by Leeds and Northrup initially for close temperature control but adaptable anywhere that the initial impulse is electrical or transmutable into an electrical impulse.

The description of the Micromax Electric Control together with the drawings depicting the installation and operation of this control are taken from literature supplied by the manufacturer.

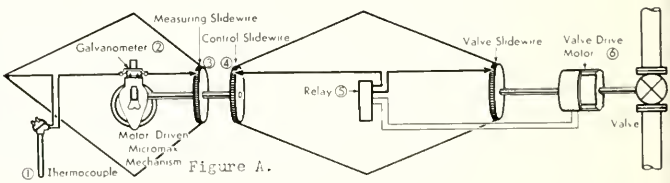


Figure A.

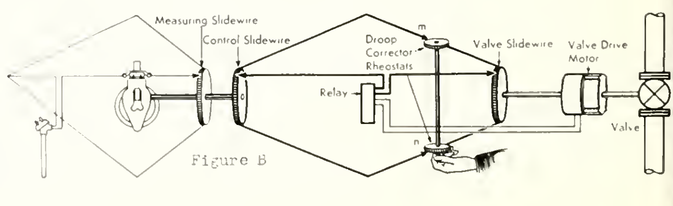


Figure B

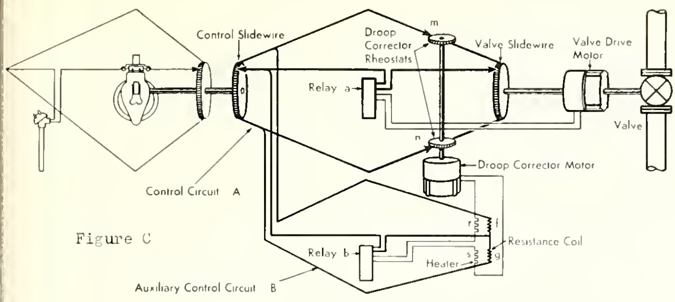


Figure C

The Basis of M.E.C. Control (Figure A)

(1) When temperature, for instance, varies from the required value, the change in thermocouple emf unbalances the measuring circuit. (2) The galvanometer deflects and engages the motor-driven Micromax mechanism, which turns (3) the measuring slidewire to restore measuring-circuit balance and at the same time (4) turns (mechanically) the control slidewire, on the same shaft, to unbalance the control circuit. Just as measuring-circuit unbalance deflected galvanometer, so control-circuit unbalance actuates the relay (5). The relay energizes the valve-drive motor (6), which simultaneously turns the valve to readjust fuel supply, and the valve-slidewire to restore control-circuit balance.

With the above basic circuit, each temperature within the throttling range would have a corresponding valve position. If the load for which the control had been adjusted were to undergo a sustained change, the valve could not take the position necessary to bring temperature of the changed load back to control point . . . and the control curve would "droop."

A manual method for controlling the temperatnre within narrow ranges is a "manual droop corrector." (Figure B.)

To bring the changed load to control temperature, it must be possible easily to establish a new relationship between temperature and valve position. The relationship is therefore made adjustable by equipping all M.E.C. Controls with rheostats *m* and *n*. By turning these, the operator changes the relationship of the resistances in the control circuit so that balance occurs with the valve in whatever position may be necessary to eliminate droop.

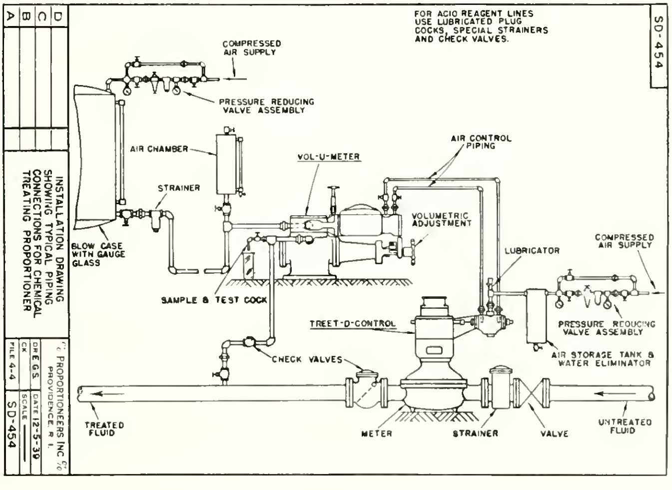
This correction may also be made automatically (Figure C). When temperature varies from the required value, control slidewire movement unbalances not only Control Circuit A, but also Auxiliary Control Circuit B. Unbalance in Circuit B causes relay *b* simultaneously to energize droop-corrector motor as well as heater *r* or *s*. While unbalance in Circuit B is causing the droop-corrector motor to turn the rheostats *m* and *n* in Circuit A, heat from *r* or *s* is temporarily raising the temperature of coil *f* or *g*, and therefore its resistance. When this temporary change in resistance balances Circuit B, the droop-corrector motor stops. At the same time, heater *r* or *s* is no longer energized, so that coil *f* or *g* begins to cool. In cooling, its resistance lowers so that Circuit B is again unbalanced, and relay *b* again energizes droop-corrector motor and heater *r* or *s* until temporary balance is again reached in Circuit B. This action persists until Circuit B reaches final equilibrium with resistance in coils *f* and *g* equal. This can only occur when temperature or other controlled condition is at the control point.

It will be noted that the Micromax Electric Control illustrated controls a valve on a line. This could be a gas line supplying fuel to a heat-treating furnace and the controller would then be utilized in maintaining a certain pre-determined temperature in the furnace. It might be applied on a steam line controlling the flow of steam through the line, thus, in turn, controlling the temperature maintained at the point at which the steam is being used.

It will be noted that this method of control is complex as compared with the method of control previously described for the temperature in a room. The control with the Micromax Controller is to a much narrower temperature range than would be possible with such control as was illustrated in the heated room.

The other disturbing feature, localized control, is still serious. This is true particularly when, for example, it is desired to control the composition of a mixture in a large reaction vessel. The efficiency of the mixing equipment and the location of the control point are of paramount importance. For these, and certain other reasons, one manufacturer recommends the abandonment, so far as possible, of large-scale reaction equipment and processing materials in circulation. The application of this idea will be developed in one of the examples cited later.

Process control instruments, whatever may be the type, depend for their functioning on some *impulse*



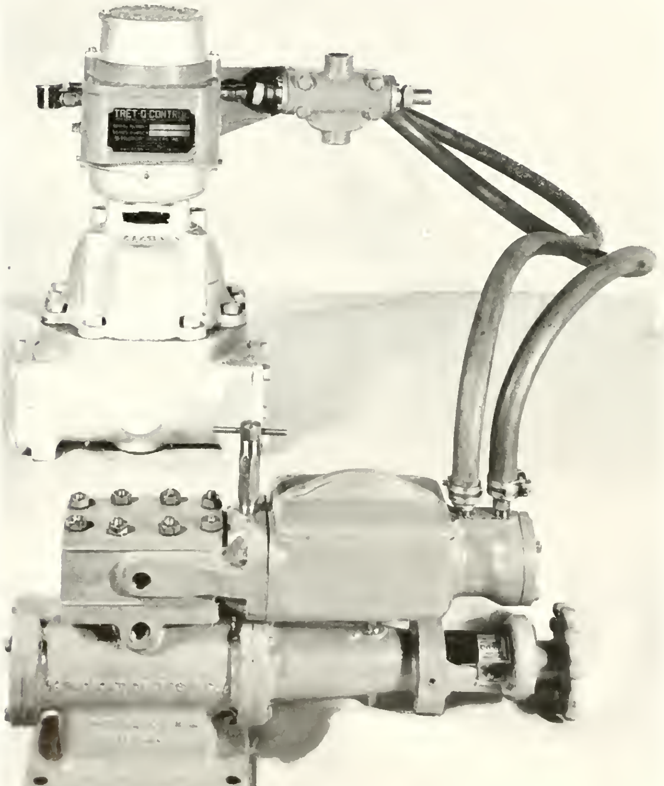
originating in the process. This may be a changing temperature, humidity, pressure, voltage or amperage, rate of flow, density, or hydrogen ion concentration. There are others but the major ones have been stated.

The industrial control of humidity is one of the most difficult items we have to control either manually or automatically. There are two methods of making such control. Both of these depend for their operation on differences existing between wet and dry-bulb conditions. One of them utilizes for control the differential temperature between special types of wet and dry-bulb thermometers, translating these temperature differences into an electrical impulse which is then passed through a Micromax Controller actuating the device, by which more or less moisture is added to the air being circulated through the space in which humidity control is desired.

The other method of control depends for its operation on the length of a number of strands of human hair at varying moisture conditions. It sounds as if this method of control might not be very accurate; yet in practice it has shown itself to be one of our best methods of securing humidity control.

An exemplification of the *ratio control* of two liquids, entering into a common stream and thus being in the required proportions for a satisfactory reaction is to be found in the Treet-O Control system, designed and built by % Proportioneers, Inc. % and used in the refining of cottonseed or any other oil. Briefly the process consists in adding a predetermined quantity of sodium hydroxide solution of the desired concentration to a measured quantity of oil. The soap so formed is then removed by passing the mixture of oil and soap through a centrifuge.

% Proportioneers, Inc. % Treet-O-Control system consists of a flow-responsive master-meter in the line carrying the oil to be treated, and a secondary adjustable displacement meter in the line carrying the treating chemical. These are linked together by control lines. Combination of these two units can be operated at any rate between maximum and minimum depending upon the number of centrifuges in operation at any given time. The operator can control the entire system with a single valve which regulates the rate at which the oil flows through the master Treet-O-Control Meter. The secondary chemical meter then follows this first unit, revolution for revolution. The caustic-oil ratio is adjusted by a displacement adjustment on the chemical meter.



High frequency is achieved by the use of wear resistant materials such as Illium and Stellite with the result that the chemical meter can operate at anywhere from 90 to 120 RPM when the oil flow through the master meter is 10 GPM. Standard Treet-O-Control units for treatment of food product oils can be obtained in accordance with the following schedule:

UNIT A

Oil Maximum	15 GPM
Caustic Maximum	0.80 GPM

UNIT B

Oil Maximum	25 GPM
Caustic Maximum	2.17 GPM

Larger capacity units are also available.

The same equipment applies to other applications such as the acid treating of lubricating oils, and solvents; blending of lubricating oils, and solvents; blending of fatty acids, silicates, soda ash, light oils and perfumes in the manufacture of soaps; blending of fatty acids and oils in the manufacture of driers and paints.

The installation drawing of the equipment is shown in SD-454 while the "brains" of the installation are shown in the photograph.

Industrial control of hydrogen ion concentration is desired in many of our chemical engineering processes. A hint as to how it might be installed is given. Assume that two liquids are being proportioned to a certain final hydrogen ion concentration. We can then flow a part of our final product

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MOTION STUDY AND THE ENGINEER

By

HENRY P. DUTTON

Motion study has enjoyed an in-reasing popular interest. Last year conference on time and motion study, eld in Chicago, and to be repeated his November, drew over a thousand ien from industry. It may be of nterest to the readers of the ENGI-EER to find out what is meant by ime study and what possibilities it olds for the engineer and for the ommunity.

Curiously enough the whole sub-ect, front-page news although it has een in industrial journals for the ast few years, is at least forty or fty years old in nearly all of its ssentials. A young contractor by the ame of Frank Gilbreth was led by ssociation with F. W. Taylor and an nsatiable curiosity to pioneer, with he able assistance of his wife, prac-cally all of the techniques today in se. Most operating men, however, aid to themselves: "This is interest-ng laboratory research, but it does ot concern us." About 1930, *Factory Ianagement and Maintenance*, an in-ustrial publication, began to feature ccounts of what had been accom-lished by the application of motion tudy techniques. Today there is a ave of interest and adoptions of this echnique.

What is this modern magic which s being taught by schools and by igh-priced consultants, and for which uch claims have been made? When ne examines it in detail, the mystery apidly evaporates. The procedure is ased on simple methods for the re-ned observation of what happens hen a man works. Such observation sually uncovers possibilities for im-rovement.

To a very surprising extent, indus-rial executives (and the situation is y no means confined to industry) are pt to give a man an order and leave im to work out his own procedure. n the case of a workman, the natural ing is to follow the traditional procedure, or if the task is new, to improvise procedures and work them out with the available materials and tools without much help from management. Also, the average workman has never been taught to be conscious of the time element; his attention has been focused on the quality or the result, and much less on procedure. The wastes which result from such haphazard planning would be perfectly obvious if one looked at them in detail. For example, a man may drill hundreds of pieces on a drill press every day. Each time he reaches above his head to start his machine. He may in some cases go through an extremely awkward and time-consuming procedure in clamping and holding each piece.

The workman does not question these wastes, sanctioned as they often are by long custom. He expects to work with the machines which have been given to him. The management does not question them. It assigns the work, and assumes that the worker will carry the orders out. Between the two stools, the job falls to the ground. So the first thing to do when one makes a motion study of an operation is to examine details step by step, and to ask himself for each step, "Is this the best, the most laborsaving method of performing this step?" Startling results often follow this examination. It is not uncommon to find that the work can be done in one-tenth of the time, and this with very little in the way of extra equipment and with no additional effort on the part of the worker. Trained examination simply discloses the fact that nine out of ten of the motions used have contributed nothing to the result, and could be eliminated. This ratio, of course, is not typical. Experience indicates, however, that in shops where systematic motion studies have been made, the savings may well average one-third on routine manual operations.

When one begins to observe details, he is led to finer and finer observation. In this, the work truly follows the development of engineering analysis. Gilbreth, for example, worked out a classification of motions of the hands, classifying them in such simple elements as grasp, transport loaded, release load, etc. There were about seventeen of these motion classes in his original analysis. Take as an example the drill press operation just mentioned. To make an analysis of it from this standpoint of recording the small elementary operations by which the total task was performed, one would take the right hand, and, watching the operator, proceed to list in order: grasp part, transport to drilling table, hold, and so on through the series of operations. Then one would watch the left hand perform the corresponding set of operations.

A refinement soon came into use in making the analysis. The moving picture camera provided the perfect mechanism for making detailed synchronized records of what the operator was doing. For refined observations, motion study engineers quickly began to work from the camera record, rather than from direct observation. The camera also permitted a very exact measure of the time for each element, since the average motion picture camera is speeded for sixteen frames or exposures per second, or approximately one thousand per minute. By counting the number of exposures or by photographing a fast-moving clock in the picture, it becomes possible not only to record the motions, but to measure quite exactly the time they take.

Either by unaided visual observation, or by means of the recording arrangements just described, we can now picture the engineer as having before him a chart showing in par-

allel, and if desired, to time scale, the motions performed by each hand in putting the piece in the drill press, bringing down the drill and drilling the part, releasing the drill, removing the part, and brushing away the chips.

This record in itself changes nothing. I well remember the sense of frustration with which two students presented a chart on which they had spent many hours of labor and said: "Professor, what do we do now?" However, a careful scrutiny of the chart is likely to reveal some interesting details. For example, one hand may have been engaged for nearly all of some operations in holding the part. As one engineer put it in talking to his foreman: "The poor girl who did this must have been a cripple. She worked entirely with one hand. Why not develop a simple foot-operated holding device and relieve the one hand?" This was done in the case mentioned. But it soon became apparent that further economies would be possible. By combining another technique, that of measuring the length of motions, with the technique of measuring the time required, it was noticed that for each part tapped the woman operator had to reach above her head to grasp the lever which controlled the tapping machine. A little ingenuity at once suggested that the tapping head be controlled by a foot pedal. This was done, and at once nearly one-half the fatigue involved in the job disappeared. Other improvements resulted when a chute was arranged back of the drill press, so that instead of picking up the piece and removing it from the press, all that was necessary was to push it into the chute. Finally, a little electric contact was arranged which automatically brought down the tapping head when the part was put into position. When the operation was finished, the time required was less than one-half the previous time; the fatigue was reduced in an even greater ratio.

Most of the examples of motion study work so far published have been in the field of the lighter repetitive manual operations, but it will at once suggest itself that many office procedures involve light manual operations, some of which are repetitive on a large scale. A bank, on analysis, found that some thirty per cent of its two thousand employees were engaged in routine clerical tasks, and made a profitable application of motion study.

What applies to light operations applies even more to heavy ones, where the weight involved and the muscular efforts are so much larger, and while it may not be practicable to have a trained motion study engineer analyze operations to be performed only once or twice, it is practicable to indoctrinate every shop employe with the simpler procedures of motion study, so that before he starts an operation he will mentally analyze it and use an efficient method.

As a matter of fact, the true importance of motion study probably lies in this last suggestion, for there are many classes of work which because of their limited volume will not stand the expense of engineering analysis. It has been shown by experience that savings nearly as great may be made when the men themselves understand the rules of motion economy.

Naturally, the various possible kinds of waste motions in operations have been studied, recorded and classified. Almost instinctively a trained motion study engineer asks himself: "Could this operation be performed simultaneously by both hands? Is the work pace arranged for greatest economy of effort? Is the rhythm of the work good? Are unnecessary motions performed?"—and so on through a list of some twenty or thirty published rules. There is no doubt that this list will grow with the practice of the art.

So much for the procedure. It would be impossible to describe it fully in a single article and there are many published articles and books describing it in detail. A new procedure which promises savings as large as these is an important one particularly at a time when the nation faces a gigantic need for new production.

Certain questions will at once occur to the reader regarding this work. If one person under direction of a motion study man can do the work of ten, or even if more typically, two can do the work of three, there is the question of where the employees thus released will turn for a living. This is an old, old problem. Every time the engineer invents a new machine, we face the same problem, and have faced it since time bgan. In a broad sense, the answer is clear. When more is produced, there will be more to divide. In the light of today's urge for rapid preparation for defense, this question will not be as much to the fore as it has been during the lean years following the great depression, but it is there, and we might as well face it. We have not perfected yet all the machinery necessary to employ to the advantage of the individual and society all of the energy released by the machine or by the improved technique of the motion study man. But we should not for this reason discontinue our technical advances. Rather we should seek so to coordinate our industrial effort that the full social advantage of these advances may be realized without letting the cost of the change fall wholly on the shoulders of the worker. Discretion in introducing changes suddenly (if necessary enforced by such legislation as the unemployment insurance provisions) is basically the answer to these problems.

Anyone who has worked in a shop will at once sense another problem. What do workers think of the time and motion study man? To this there seems to be developing rather a surprising answer. Workers do not like and never have liked time study. This article has not attempted an exposition of time study practice but, in brief, the purpose of making a time study is to set a time for the performance of a task as the basis for payment for the task. (Obviously, a knowledge of the time required is a by-product of a good motion study. Simply by adding the elementary times, with proper allowances for interruptions, fatigue and other nonroutine items, one arrives at the correct time.) In the past many time studies have been made without adequate motion analysis. When neither side knows exactly how long a task should take, there is a considerable area for discussion as to what the exact time and payment should be. The job of the time study man is traditionally a controversial job. The time study man is tolerated; the workman realizes that some sort of a measurement is necessary, but it would be a mistake to expect him to enjoy the process, particularly since he does not understand it and has little voice in it.

It is clear that the same element enters incidentally into motion studies, but there is an interesting difference

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TIME AND MOTION STUDY CLINIC

Dean Dutton's article in this issue suggests the increasing importance of time and motion study in improving the efficiency of industrial production. Our Summer Graduate Institute course in this subject, given by Professor Ralph M. Barnes of Iowa State University, was particularly interesting and was well attended, the registration being approximately fifty.

The Industrial Management Society will hold its third national time and motion study clinic at the Chicago Towers Club, November eighth and ninth. Engineers concerned with production will find much of interest in the program. Professor Leonard J. Lease, Industrial Coordinator on our faculty, is chairman of the program committee.

ARMOUR - LEWIS PROGRESS IN CONSOLIDATION

By

C. A. TIBBALS and C. L. CLARKE

The December, 1939, issue of the ARMOUR ENGINEER AND ALUMNUS published an account of the agreement reached on the preceding October 26th by the Boards of Trustees of Armour Institute of Technology and of Lewis Institute to consolidate the two schools and to form from the union, Illinois Institute of Technology. In the May number of the ENGINEER AND ALUMNUS in which progress on the merger was described, it was pointed out that since the charter of Lewis Institute was the will of its founder, the late Allen C. Lewis, the carrying out of the agreement required Court approval. Accordingly, on November 25th, a friendly suit was instituted in the Circuit Court of Cook County before Judge Robert Jerome Dunne, the parties to the suit being Lewis Institute and Armour Institute of Technology, and the Attorney General of the State of Illinois.

Judge Dunne handed down a decree approving the consolidation, and on July 24, 1940, immediately following the issuance of the decree, the Illinois Institute of Technology, A Consolidation of Armour Institute of Technology and Lewis Institute, became a legal entity.

The purpose of the writers is to describe briefly the steps which have been taken toward the actual consolidation of the two colleges, the organization of the Illinois Institute, and the general status of the Institute at the opening of its first year.

The Board of Trustees of the Illinois Institute of Technology is made up of all the members of the respective Boards of the combining institutions. Its officers are: James D. Cunningham, Chairman; Alex D. Bailey, Vice Chairman; Alfred E. Enstice, Secretary; George S. Allison, Treasurer; Harold Vagtborg, Executive Secretary.

Henry T. Heald was elected President of Illinois Institute of Technology and Linton E. Grinter, Vice President. On September 11th, the President announced Divisional and Departmental organization of the Institute as follows:

ARMOUR COLLEGE OF ENGINEERING—Dean, Charles A. Tibbals

Department	*Director or Chairman*
Architecture	Ludwig Mies van der Rohe
Chemical Engineering	Harry McCormack
Civil Engineering	Philip C. Huntly
Electrical Engineering	Ernest H. Freeman
Fire Protection Engineering	Joseph B. Finnegan
Mechanical Engineering	John I. Yellott
Mechanics	Charles E. Paul
Social Science	Henry P. Dutton
*Chemistry	B. B. Freud
*English & Languages	Walter Hendricks
*Mathematics	Lester R. Ford
*Physics	James S. Thompson
*Physical Education	John J. Schommer

LEWIS INSTITUTE OF ARTS AND SCIENCES—Dean, Clarence L. Clarke (Formerly Co-Director and Dean, Lewis Institute)

Department	*Director or Chairman*
Applied Art	Marie E. Blanke
Biology	Leslie R. Hedrick
Business & Economics	Judson F. Lee
Education, Psychology & Philosophy	Clarence L. Clarke
History, Political Science & Sociology	John D. Larkin
Home Economics	
*Chemistry	B. B. Freud
*English & Languages	Walter Hendricks
*Mathematics	Lester R. Ford
*Physics	James S. Thompson
*Physical Education	John J. Schommer

*Departments common to both colleges.

EVENING DIVISION—Dean, Henry P. Dutton

GRADUATE SCHOOL—Dean, Linton E. Grinter

All active members of the staffs of the combining colleges continue as members of the reorganized faculty of the Illinois Institute.

The educational program, involving actual consolidation on the two campuses, is proceeding according to the following plan:

Instruction in day classes of engineering students beyond the freshman year on the Lewis campus is discontinued and all engineering students previously enrolled in Lewis Institute become automatically students of Armour College on the South Side campus.

About sixty freshmen, admitted to Armour College of Engineering, are following their complete freshman program of study on the Lewis campus.

In all departments where possible and practicable, exchange of faculty members between the two campuses has been arranged in the interest of acquaintanceship and unity.

The Evening Division program has been divided between the two campuses, avoiding unnecessary duplication of courses, and extending the college credit program in engineering, under the single direction of the Dean of the Evening Division.

All graduate work, in Science as well as in Engineering, remains on the South Side campus.

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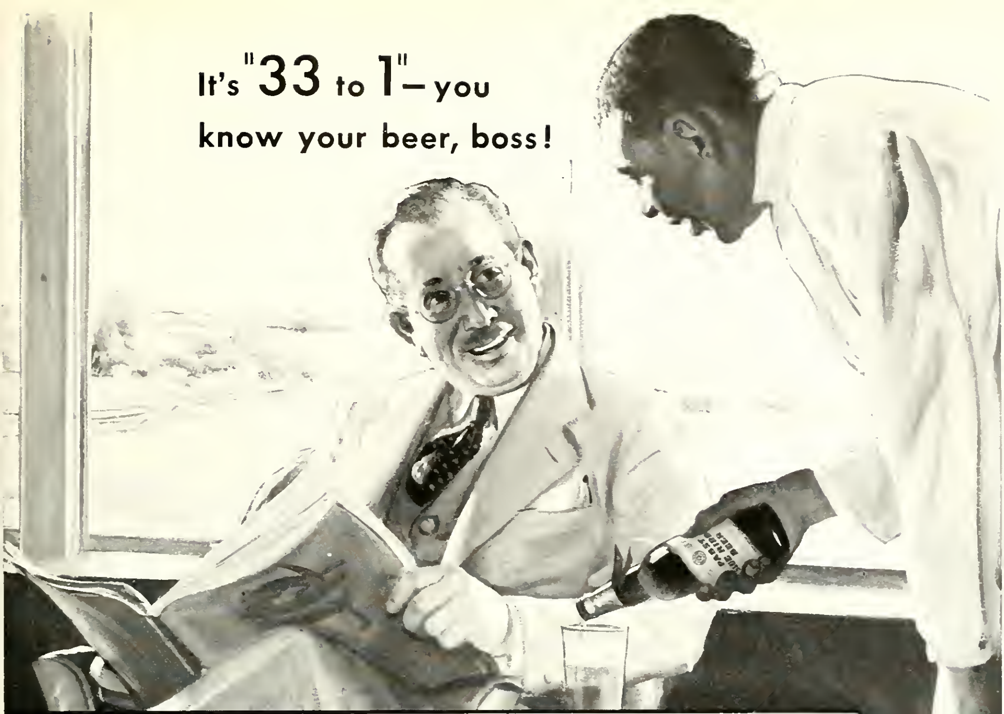
It's "33 to 1"—you know your beer, boss!



Blended 33 Times to Make One Great Beer

It takes 33 separate brews to make a single glass of Pabst BLUE RIBBON!

You know it's *blending* that makes fine wines, coffee, and tobacco so good. And those who drink Blue Ribbon can tell you what blending does for *beer!*

Try a glass of Pabst Blue Ribbon today. First enjoy the *look* of it—the clarity, the sparkle, the billowy head. Then enjoy your discovery of what beer flavor and beer smoothness can be!

In that glass—and in *every* glass of Blue Ribbon—is a blend of not two, or five, or twelve . . . but *33* separate brews from 33 separate kettles.

Each brew is as fine as choicest ingredients and Pabst's 96 years of experience can make it. Then all 33 are brought together in perfect balance.

An expensive way to brew? Of course! But that's what makes Blue Ribbon *America's premium beer,* with a smoothness that is unique . . . and a goodness that never varies.

Sometime today, have the pleasure of meeting Blue Ribbon.

. . . WITH A BLUE RIBBON ON IT!

It's the **BLEND** *that Betters the Beer*

Try **Pabst Blue Ribbon** *and Prove it*

First in the Homes of America—and the Largest Selling American Beer in the Rest of the World!

TRUSTEES

JOSEPH G. ALTHER is well known for his research in the petroleum refining industry. He is a native of Chicago, and joined the Universal Oil Products Company in 1916. He is self-educated in the fundamentals of oil processing, having studied and experimented in the backyard laboratory of the famous C. P. Dubbs, inventor of the widely known Dubbs cracking process. Mr. Alther became Secretary of Universal Oil Products in 1918, and Vice President in 1928. In 1932 he conceived the idea which finally matured in 1936 in patents covering the Universal Equiflux furnace. He has been responsible for many other inventions.

BION J. ARNOLD was born near Grand Rapids, Michigan. He attended the University of Nebraska; received his B.S. degree at Hillsdale (Michigan) College in 1884, and his M.S. degree in 1887; did graduate work at Cornell; received his E.E. degree at the University of Nebraska in 1897; and has honorary degrees from Hillsdale, Armour, and Nebraska. He has had a most notable record in consultation work, design, and construction of transportation systems and other public utilities in all parts of the United States and Canada. He has made numerous inventions in the field of electrical equipment, and has been a member of many boards and commissions. During the first World War, he had assignments to naval and army duties, and attained the army rank of colonel. He is a trustee of Hillsdale College and has been a member of the Board of Managers of Lewis Institute. Mr. Arnold is a member of the American Institute of Electrical Engineers (President 1903-1904); member of the Western Society of Engineers (President 1906-1907); member American Association for the Advancement of Science; member of the Society for the Promotion of Engineering Education; member of the Inventors Guild; member and past president of Aero Club of Illinois; member of the Military Order of the World War (past commander of the Chicago Section); and member of many other engineering and military organizations. His clubs are Engineers (New York); Union League; South Shore; Commercial; Engineers; and Army and Navy. Mr. Arnold lives at 4713 Kimbark Avenue.

ALEXANDER D. BAILEY was born at Salem, Wisconsin. He graduated from Lewis Institute in 1903 with the degree of M. E., and in that same year entered the employ of the Commonwealth Edison Company, where he has since served continuously in the Engineering and Operating Departments. He is now Chief Operating Engineer.

Mr. Bailey has been active on engineering and research committees in the following engineering societies: Edison Electric Institute; National Electric Light Association; Association of Edison Illuminating Companies; Western Society of Engineers; and The American Society of Mechanical Engineers (Past Vice-President and Senior Councillor). He is a member of Tau Beta Pi; a Director of Utilities Coordinated Research; was President of the Board of Trustees of Lewis Institute; is a member

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of the Education Committee of the Chicago Association of Commerce; and a member and Director of the Union League Club of Chicago. He resides at 114 South Kensington Avenue, La Grange, Illinois, where he is a member of the Civic and Country Clubs, and was a Village Trustee for fourteen years, serving the last two as President of the Board.

JUDGE JOHN P. BARNES was born in Beaver County, Pennsylvania. He graduated from Geneva (Pa.) College in 1904 with the degree of B.S. He was honored with the LL.D. degree in 1936. At the University of Michigan he received the LL.B. degree in 1907, and the honorary degree of LL.M. in 1933. He engaged in the general practice of law in Chicago from 1907 to 1931, except for the period from 1913 to 1914, when he was first assistant

county attorney of Cook County. Since 1931 he has been Judge of the United States District Court for the northern district of Illinois. Judge Barnes is a member of the American, Illinois State, and Chicago Bar Associations, and of the Union League Club. His home is at 205 South Spring Avenue, La Grange.

ARTHUR J. R. CURTIS is of New England and Scotch Canadian ancestry. His New England forebears were active in the Revolution; afterward they moved to the Western Reserve country, where they engaged in clearing off timber and building canals. His grandfather moved his sawmill to South Bend, where he supplied the Lake Shore Railroad with millions of feet of timber for its original bridges and other structures. Mr. Curtis's father left college to join the Union Army. At the time of his death, his son was fourteen, and went to work in a lithographing shop. He saved his money until he was able to enter Lewis Institute, taking advantage of an opportunity that has come to several thousand other boys. He graduated in 1910 with the degree of M.E., and has ever since been engaged in

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research, promotion, or industrial relations work with the cement industry. Since 1927 he has been Assistant to the General Manager and Secretary of the Committee on Accident Prevention and Insurance. He is Secretary of the Cement and Quarry Section of the National Safety Council; he has been a member of the Board of Managers of Lewis Institute; and is a member of the American Society of Agricultural Engineers. During the first World War, Mr. Curtis was inspector of military concrete schools. He is a member of the Union League Club, and lives in River Forest.

ADOLPH H. FENSHOLT was born in Chicago. He is a graduate of Lewis Academy in the class of 1909, and of Lewis Institute in the class of 1913. His training has been varied, with experience in teaching, engineering, research, and advertising. He served as engineer for the Chicago Traction Board in 1913-1914, and as sales and advertising manager for the Kimble Electric Company from 1917 to 1919. During the first World War he was a technical expert with the General Staff at Washington. He has also been instructor in physics and assistant professor of electrical engineering at

Lewis. In 1922 he organized the Fensholt Company, sales and advertising counsellors for manufacturers. Mr. Fensholt has been a member of the Lewis Board of Governors and President of the Lewis Alumni Association.

HOWARD W. FENTON was born in Indianapolis. He began work with N. W. Harris and Company in 1895, continuing with its successor, the Harris Trust and Savings Bank; he became treasurer in 1907, director and member executive committee in 1909, vice-president in 1911, and president in 1923. He has been chairman of the clearing house committee of the Chicago Clearing House Association since 1936. Mr. Fenton is a member of the Indiana Society of Chicago, and of the Bankers, Chicago, Union League, Attic, Shore Acres, Indian Hill, and Old Elm Clubs. His home is in Lake Forest.

CHARLES GETLER is a native of Buffalo, New York. He is Director and President of the Houdaille-Hershey Corporation of Detroit; Director and Vice-President of the Houde Engineering Corporation of Buffalo; Director of the Muskegon Motor Specialties Company; and Director and Vice-President of the Skinner Company, Ltd., of Oshawa, Ontario.

CRAIG BEEBE HAZLEWOOD was born in East Aurora, New York. He is a graduate of Lewis Institute and was a student at the University of Chicago for two years. He has been vice-president of the Union Trust Company, and vice-president of the First National Bank; and a member of the American Bankers Association, the Reserve City Bankers Association, and the Bankers Club of Chicago. Mr. Hazlewood has been a member of the Lewis Board of Trustees since 1922. He belongs to the Chicago, Mid-Day, Glenview Golf, and Bob-o-Link Clubs. His home is in Evanston.

DR. JAMES B. HERRICK was born in Oak Park. He received his A.B. degree at the University of Michigan in 1882, and his M.D. degree at Rush Medical College in 1888. His honorary degrees comprise M.A., Michigan, 1907; LL.D., Michigan, 1932; Sci. Doc., Chicago, 1938, and Northwestern, 1940. For thirty-six years he was on the faculty of the Department of Medicine at Rush Medical College, and was for a time head of the department; he is now emeritus. Dr. Herrick was attending physician at the Cook County Hospital for twenty years, and since 1891 has been attending physician at the Presbyterian Hospital of Chicago. He is a member of the Chicago Medical Society and of the American Medical Association; founder and first president of the Chicago Society of Internal Medicine; a governor of the Institute of Medicine of Chicago (President, 1925); member and at one time President, Association of American Physicians; President of Congress of American Physicians and Surgeons; member and for seven years Regent of American College of Physicians. His writings include many contributions to medical journals on subjects relating to internal medicine (especially heart disease) and to medical education. Among the special honors which have been conferred on him are the Kober Medal of the Association of American Physicians; the Distinguished Service Medal of the American Medical Association; and the certificate as "Master" of the American College of Physicians. For some thirty years Dr. Herrick has been a trustee and a member of the Board of Managers of Lewis Institute, and at one time served as president of the board.

HARVEY BRACE LEMON was born in Chicago. He received his A.B. degree at the University of Chicago in 1906, the M.S. degree in 1910, and the Ph.D. degree in 1912. He began his teaching at Chicago as an in-

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structor in physics, and is now professor. He served as captain in the Ordnance Department in 1918. He is a fellow of the American Physical Society; member of the American Association for the Advancement of Science, and the American Association of Physics Teachers; member of Delta Upsilon, Phi Beta Kappa, Sigma Xi, and Sigma Pi Sigma; member of the Quadrangle and Chicago Literary Clubs. Professor Lemon is author of *From Galileo to Cosmic Rays; Cosmic Rays Thus Far;* and one of the authors of *The Nature Of The World And Of Man.* His home is at 5805 Dorchester Avenue.

J. WARREN McCAFFREY is a graduate of Armour in the class of 1922. In 1925 he received the degree of Chemical Engineer. After the completion of his engineering education, he studied law at the Chicago Kent College of Law, and is now President of the Patent and Engineering Service Company, patent attorneys. Mr. McCaffrey is a member of the American Legion, the Patent Law Association of Chicago, the Illinois State Bar Association, and the South Shore Country Club. He is a representative of the Armour Alumni Association on the Board of Trustees.

WILLIAM H. REGNERY was born in Sheboygan, Wisconsin. He began his business life as a messenger boy for the Western Shade Cloth Company and is now its president. He is active in civic affairs in Hinsdale, where he is village president and chairman of the board of the First National Bank. Mr. Regnery is President of the Standard Shade Roller Company, Vice-President of the Joanna Cotton Mills, and a trustee of Beloit College. He is a member of the Union League Club, the Knollwood Club, and the Hinsdale Golf Club.

WILFRED SYKES was born in Palmerston, North New Zealand. At the age of five years he was taken by his parents to the State of Victoria in Australia, where his father had several lumber mills. Later he attended the Technical College and the University of Melbourne, graduating with a B.S. degree. After graduation he was employed by the firm of Knox Schlapp & Company as an engineer in the electrical department; later he became manager of that department. In 1907 he entered the employ of the Allgemeine Elektrizitäts Gesellschaft in Berlin, Germany, remaining there until 1909; he then came to the United States and entered the employ of the Westinghouse Electric & Manufacturing Company at East Pittsburgh. In 1920 he was appointed executive engineer for the Steel & Tube Company, and in 1923 became engineer in charge of construction for the Inland Steel Company. Subsequently, he was Assistant General Superintendent of the Indiana Harbor plant, and in 1930 was appointed Assistant to the President, in charge of operations. Mr. Sykes is a fellow of the Royal Arts Society; a member of the American Institute of Electrical Engineers; a director of the American Institute of Mining and Metallurgical Engineers (Chairman of the Chicago Section); a member of the American Iron and Steel Institute; and a member of the American Society of Naval Engineers. His home is in Flossmoor.

HARRY LORD WELLS was born in Janesville, Wisconsin. He received his A.B. at Lewis Institute in 1899, and at Harvard in 1902. For many years he was active in building construction in Chicago, as secretary, and subsequently as vice-president and treasurer, of Wells Brothers Construction Company. He was admitted to the bar in 1905. Mr. Wells has been supervisor of the real estate loan department of the First National Bank, a director of the Hotel Winton, Cleveland, a director of the Neil House, Columbus, a director of the Infant Welfare Society, and since 1921 a member of the Board of Managers of Lewis Institute. He is a life member of the Art Institute of Chicago, and a member of the University, Harvard, and Commonwealth Clubs. His home is in Hubbard Woods.

BENJAMIN WHAM was born in southern Illinois. He attended the University of Illinois, where he received the degrees of A.B. in 1915, and J.D. in 1917. During his student days he was on three varsity debating teams; was a member of the honorary senior society, Mawanda, and of Phi Beta Kappa and Phi Delta Phi; and was president of his class in its senior year. He was a First Lieutenant of Infantry in the Blackhawk Division, and served overseas in the first World War. He practiced law in Decatur, and since 1920 has practiced in Chicago; he is now

Blank & Stoller Photo

head of the firm of Wham and O'Brien. Mr. Wham was legal secretary to the Speaker of the House at Springfield in 1923; he is First Vice-President of the Illinois State Bar Association; he has been chairman of committees of the Chicago Bar Association. In 1935, he won the Ross Bequest Essay Contest of the American Bar Association, which carries a cash award of $3000. He is now trustee of the Chicago and Eastern Illinois Railway Company in a Section 77 (Bankruptcy Act) proceeding. Mr. Wham is a member of the Law Club of Chicago, the Legal Club of Chicago, the Literary Club of Chicago, and the Chicago Crime Commission. He is also a member of the Chicago Club, the University Club, and the Indian Hill Club. He is the author of legal discussions on reorganizations and on other branches of the law, which have appeared in the American Bar Journals and other law journals. His residence is in Winnetka.

THE BOOK SHELF

In this century it seems almost sententious to remark that history is continuous, that in the past lie the causes, and consequently the explanations, of the present. Perhaps that fact is more evident to us now than it has ever been; we live in a day when the newspaper headlines are no mere announcements of extremities of the weather, but are rather chapter headings in universal history. As a consequence, those who live in countries which still afford some opportunity for speculation about the plight of the world are likely to regret the inadequacy of their historical information; indeed, perhaps most of us have the sense of having come in at the middle of the movie of world events; since the movie will not be repeated, we shall have to get, somehow and somewhere, a synopsis of the earlier reels, if we are ever to understand the course of our own lives; and we can get this synopsis, of course, only from history.

Unfortunately, however, a fine bewilderment awaits the average reader in search of historical knowledge: as Mr. H. G. Wells remarks in the preface to the most recent edition of his *Outline of History*, historians seem to assume the omniscience of the general reader; to them, apparently, the man in the street is a sort of Macaulay's schoolboy perfectly aware of the fortunes of Titus' candlestick, of the treasures of Alaric, and of the manuscripts of Buridan; and a succession of erudite disputes about dates and evidence can rapidly dampen the eagerness of one, let us say, who merely wanted to know whether anyone was standing nearby when the Roman Empire fell. The ordinary reader, in his final bafflement and despair, is likely to wish ardently either for some comprehensive outlines of facts, or for some factual narrative with the pleasant readability of fiction.

Two new books seem to me to offer excellent answers to that wish. One of these is Harold Lamb's THE MARCH OF THE BARBARIANS (Doubleday Doran, $3.50). If you have never heard of Harold Lamb, you ought to look him up at once; he is the author of biographies of Genghis-Kahn and Tamerlane, and of two striking historical narratives of the Crusades, *Iron Men and Saints* and *The Flame of Islam*, as well as of a number of other books. His peculiar gift is to combine accurate historical scholarship, based on a wide study of source-documents, with something that might be called historical imagination; at any rate, he has the trick of making the past quite as immediate and real as the present. Like Robert Graves, he can do this without cheapening history into the kind of romantic costume-show which Rafael Sabatini has presented *ad nauseam*; and he never gives one the sense, as so many histories unfortunately do, that the Middle Ages passed in a perpetual tournament between animated suits of armour.

In *The March of the Barbarians* Mr. Lamb affords a bird's eye view of the medieval supremacy of the Mongols; and although that supremacy is his chief concern, he sees fit, quite properly, to include in his tale both the antecedents and the consequences of Mongol empire. Millenniums before the civilizations of the Tigris-Euphrates valley, of the Nile, of the Indus, and of the Mediterranean, the shadowy tribes of the north Asian tundras had hunted, fished, woven

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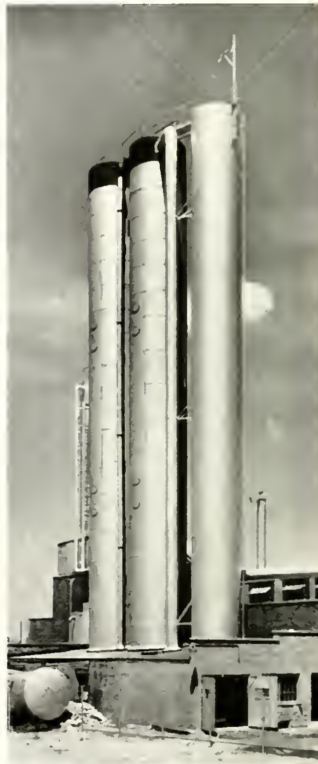


CARBON DIOXIDE from COKE

Nearly all of the carbon dioxide used today is manufactured by the "coke" process. High grade coke is burned in special furnaces with regulated drafts. The flue gas produced has a carbon dioxide content of 17 to 19 percent. After these gases have been scrubbed free of dirt and sulphur compounds they pass through coke-filled towers like those shown above. Here they meet a counterflow of lye solution that absorbs the carbon dioxide. This liquid yields pure carbon dioxide gas after a distillation process.

The Chicago Bridge and Iron Company built the welded tower in the foreground above for The Liquid Carbonic Corp. at Indianapolis, Ind.

PLACEMENT DEPARTMENT

HELP! HELP! HELP!

Suppose any one of you alumni were confronted with the job of hiring an engineer with special qualifications and training to fill a position in your organization paying from $3600 to $20,000 a year. How would you proceed? You could insert a blind ad in a newspaper or magazine, but many qualified men would not answer it. For many reasons you might not wish to reveal the name of your company. For many reasons you might not wish to use the services of a fee employment agency. You would, however, if you had any experience in this type of negotiation for good men, consult the placement bureaus of reputable engineering colleges, or ask the aid of some friend of yours whose judgment you felt you could trust. If you were a busy executive you would not wish to be deluged with applicants. So you would state the qualifications, age and experience that your ideal engineer should have and let a placement officer do the preliminary weeding out, finally submitting for your approval the qualifications of a limited number of men whose background and age fulfilled your requirements.

There are now about 1700 placement records in our office. There are approximately 4300 Armour alumni. The majority of the records from alumni are from younger men whose salaries are in the lower brackets. There are now some excellent opportunities, paying from $3600 to $20,000 a year, reported to this department. The tide has definitely turned and industry is again seeking men from thirty-five to fifty years old. Employers are again buying experience. Where is your record? Many of the records on file are those of day school students, night school students, or students who did not finish college. What this department wants is records from men of ability to fit into key positions in industry, positions paying good salaries. Write for a placement record, and when you get it, fill it out and be sure to put on it a flattering photograph of yourself and then mail it to us. A postage stamp and a little effort may be the best investment you ever made or ever will make.

The department is in need of jobs to aid poor boys through college. If you know of any part-time jobs, any evening work, Saturday or Sunday employment, holiday jobs or work for next summer, be kind enough to let us know of such openings. The department will do its utmost to send applicants for the work. There are over 400 freshmen registered this autumn. Your college is going full steam ahead. Help us go faster and better and better.

For your information, the average monthly starting salary for the Class of 1939 was $110.82. This year the average initial salary is $119.20. Last year the degree of Bachelor of Science was awarded to 137 men. According to our records, all are employed. This year 171 received the degree of Bachelor of Science. As of September 30, 1940, 96.5 per cent of this year's class have been placed.

STATUS OF 1940 CLASS AS OF SEPTEMBER 30, 1940.

Departments	Number in Class	Number Employed
Architecture	14	14
Chemical Engineering	40	35
Civil Engineering	16	16
Electrical Engineering	35	34
Engineering Science	2	2
Fire Protection Engineering	16	16
Mechanical Engineering	48	48
	171	165

JOHN J. SCHOMMER,
Director of Placement.

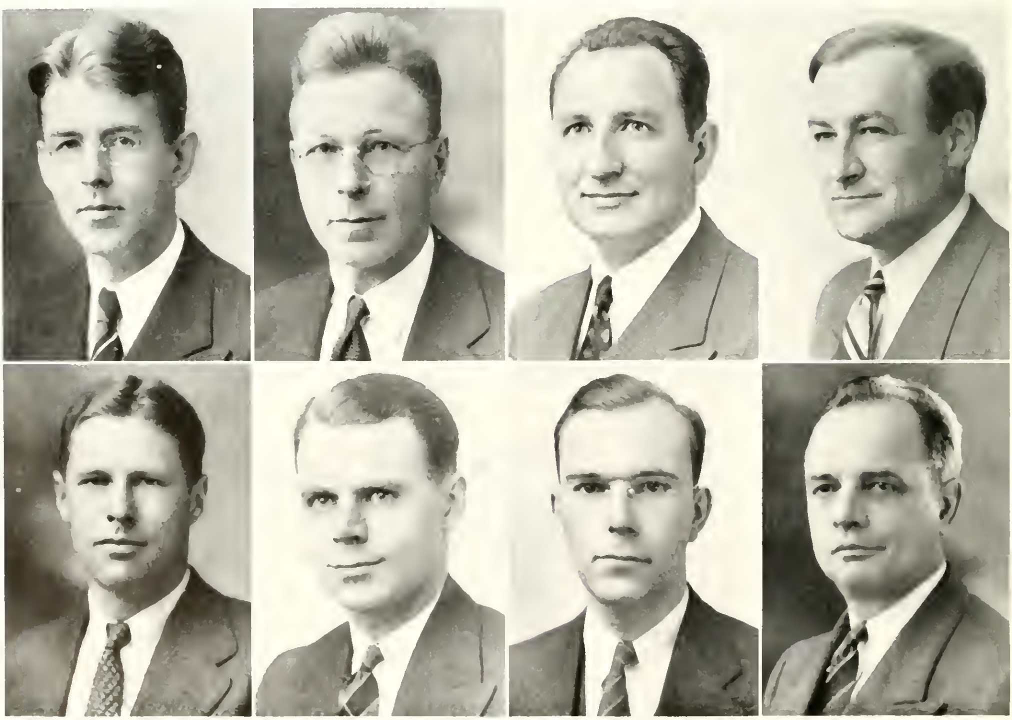
NEW FACULTY MEMBERS

LEROY T. ANDERSON, Instructor in Electrical Engineering and Physics, is a graduate of the University of Michigan, where he received the degrees of B.S.E.E. in 1933; and B.S. Math. and M.S.E. in 1934. After leaving Ann Arbor, he worked for one year with the Wisconsin Highway Department, and taught in the Departments of Electrical Engineering and Physics for five years. During summer vacations he has worked on carrier current telephony. Mr. Anderson is a member of Tau Beta Pi, Sigma Xi, Phi Kappa Phi, and the American Institute of Electrical Engineers.

PAUL G. ANDRES, Assistant Professor of Electrical Engineering, was born of American parents in Ontario. His college courses were at Michigan State College, where he received the degrees of B.S.E.E. in 1918, and E.E. in 1923. From 1918 to 1921 he served on the faculty of Michigan State College as Instructor

ANDERSON ANDRES BUDENHOLZER BUSEMAN

FLANIGAN HUDSON KANNE KOZACKA



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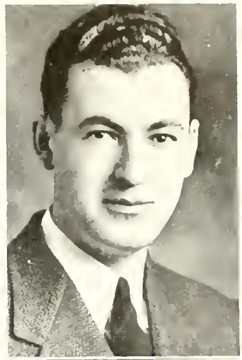


MYKLESTAD SHUMAN WADE

WINSTEIN
YELLOTT

and Assistant Professor of Electrical Engineering. He was Research Engineer for the Automatic Electric Company in Chicago from 1921 to 1925; Chief Engineer, Newcomb Hawley, Inc., St. Charles, Illinois, from 1925 to 1927; Chief Engineer, Temple Radio Corporation, Chicago and Toronto, from 1927 to 1932; and Research Engineer, P. R. Mallory, Inc., Indianapolis, beginning in 1932. He was released to the State of Indiana and the Indiana State Bankers Association, and served as Chief Engineer of the State Police Radio System from 1934 to 1936. He practiced as a consulting engineer until his appointment to the Lewis Institute faculty in 1939 as Assistant Professor of Electrical Engineering.

Professor Andres holds numerous patents, and is the author of many technical papers relating to electrical engineering and communications. He is listed in American Men of Science.

ROLAND A. BUDENHOLZER, Instructor in Mechanical Engineering, graduated in 1931 from New Mexico State College in Las Cruces, where he received the B.S. degree in Mechanical Engineering. After summer service as draftsman for the National Park Service he became a graduate student at California Institute of Technology, where he received the degrees of M.S. in Mechanical Engineering in 1937, and Ph.D. in 1939. During his graduate courses he served as a teaching assistant in the mechanical engineering and hydraulics laboratories and in thermodynamics. Dr. Budenholzer was subsequently appointed a Junior Research Fellow of the American Petroleum Institute, and worked in their laboratory on the campus of California Institute of Technology until his appointment to the Armour faculty.

HERBERT BUSEMANN, Instructor in Mathematics, studied at the University of Munich from 1925 to 1926; at Göttingen from 1925 to 1930; and at Rome from 1930 to 1931. He received his Ph.D. degree at Göttingen in 1931. He has taught mathematics as an assistant, a lecturer, and an instructor at Göttingen, Copenhagen, New York University, Swarthmore College, and Johns Hopkins University. Dr. Busemann has written numerous articles which have appeared in European scientific journals; he is the author of *Introduction to Albebraic Manifolds*, published in Princeton Mathematical Notes.

JOHN DE CICCO, Instructor in Mathematics, received his degree of B.S. at Brooklyn College in 1933, and his Ph.D. degree at Columbia University in 1938. He served as tutor and instructor at Brooklyn College from 1933 to 1940, and as assistant at Long Island University from 1939 to 1940. He held a graduate scholarship at Columbia, and was elected to the honorary scientific fraternity, Sigma Xi. He is also a member of Sigma Mu and of the American Mathematical Society. Dr. De Cicco is the author of articles which have appeared in the American Journal of Mathematics, the Proceedings of the National Academy of Sciences, and the Transactions of the American Mathematics Society.

ALAN E. FLANIGAN, Instructor in Mechanical Engineering, graduated from Princeton University in the class of 1934, with the degree of A.B., his major field having been mathematics. From 1938 to 1940 he was a graduate assistant (and in the latter year a teaching assistant) in mechanical engineering at the University of California, where he received his Master's degree in 1940. During the four years intervening between his Princeton and California university courses, he worked as an electric welder. Mr. Flanigan is a member of Sigma Xi; of the American Society for Metals; and the International Association of Mechanic Welders.

LOUIS J. HAGA, Associate Professor of Metallography, received his B.S. degree at Michigan College of Mining and Technology in 1925, and his degree of M.S.Ch.E. at Purdue in 1928. He has also done graduate work at the University of Michigan. He has been an instructor at Purdue.

and was Assistant Professor of Chemistry and Metallurgy at Lewis Institute from 1932 to 1940. Immediately after his undergraduate course at Houghton he worked for a year as draftsman for the Shaw Electrical Crane Company. From 1928 to 1932 he was a development engineer with the Western Electric Company. He is the author of a *Laboratory Manual for Physical Chemistry*, and a *Laboratory Manual for Engineering Chemistry*. Professor Haga is a member of the Society for the Promotion of Engineering Education, the American Society for Metals, and the American Foundrymen's Association.

HERBERT E. HUDSON, JR., Instructor in Civil Engineering, is a graduate of the University of Illinois. His engineering experience began with work as a rodman and draftsman with the Edwin Hancock Engineering Company. Subsequently, he was a collaborating sanitary engineer with the United States Public Health Service. Since 1934 has been Junior Sanitary Engineer for the City of Chicago. He is Secretary, Illinois Section, American Waterworks Association; and Secretary, West Shore Water Producers Association. Mr. Hudson is the author of numerous papers on sanitary engineering subjects which have appeared in engineering periodicals and in publications of engineering societies and of public bodies.

W. R. KANNE, Assistant Professor of Physics, did both undergraduate and graduate work at Johns Hopkins University, where he received his Ph.D. degree in 1937. He was then awarded a National Research Fellowship, but chose instead to accept an instructorship at the University of Wisconsin, which he continued to hold until 1940. Professor Kanne's research work has been in the field of nuclear physics; at Baltimore he worked with natural radio-active substances; at Madison he used a transformer rectifier high voltage outfit. Professor Kanne is a member of the honorary fraternities, Phi Beta Kappa and Sigma Xi.

JOSEPH S. KOZACKA, Associate Professor of Mechanical Engineering, was born in Poland, and came to the United States in 1902. He completed his secondary education in this country, and in 1910 he graduated from Pratt Institute. He received the degrees of B.M.E. and M.S. from the University of Michigan, in 1916 and 1930, respectively. He has had extensive industrial experience as an apprentice, mechanic, and engineer with General Electric Company, Pratt and Whitney Company, Windsor Machine Company, General Motors, Chrysler, Packard Motor Company, and Detroit Steel Products Company. For several years he was Director of the Alliance Technical Institute at Cambridge Springs, Pennsylvania; since 1930 he has been on the faculty at Lewis Institute. He is co-author of a book, *Mathematics For Mechanics*. Professor Kozacka is active in the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers. He has been chairman of the Chicago section of the A.S.M.E., and is now a member of the executive committee of the section.

NILS OTTO MYKLESTAD, Assistant Professor of Machine Design, was born in North Dakota, but received most of his education in Norway and Denmark. He graduated from junior college (Gymnasium) in 1926, and from the Royal Technical College in Copenhagen in 1932. During this period he worked for one year at the South Philadelphia Plant of Westinghouse Electric and Manufacturing Company, and returned to work for this company in August, 1932. He was continuously engaged in engineering work for various companies from that time until 1937. From 1937 to 1938 Mr. Myklestad was a graduate student and teaching assistant in mechanical engineering at the University of California; from 1938 to 1940 he was a graduate student and instructor in mechanics of engineering at Cornell University. He received his Ph.D. degree at Cornell in 1940.

WILLIAM T. PRIESTLY, JR., Assistant Professor of Architecture, received his B.S. degree at Princeton University in 1929; he did graduate work at the Schools of Architecture of New York University and Columbia University, and at the Bauhaus, Dessau, Germany. He has been an instructor at Dalton School in New York City, and at Cooper Union, and has been engaged in private practice as an architect.

ROBERT I. SARBACHER, Assistant Professor of Electrical Engineering, attended Baltimore Polytechnic Institute from 1922 to 1926; University of Florida, from 1931 to 1933; and Harvard University from 1935 to 1939. He received his Sc.B. degree at Florida, and his Sc.M. and Sc.D. degrees at Harvard. He served as electrical engineer for Electrical Research Products, Inc., from 1928 to 1931, and as relay and communication engineer for Florida Power and Light Company from 1934 to 1935. Dr. Sarbacher has been an instructor and research assistant at Harvard, and an instructor at Radcliffe.

EVERETT C. SHUMAN, Assistant Professor of Civil Engineering, graduated from the University of Wisconsin in 1924 with the degree of B.S. in C.E.; in 1926 he received the degree of M.S. in Structural Engineering. His first engineering work, from 1919 to 1920, was as assistant to the City Engineer of North Milwaukee. He was instructor in mechanics at the University of Wisconsin from 1924 to 1926; assistant engineer under Duff A. Abrams at the research laboratory of the Portland Cement Association (then at Lewis Institute), later becoming associate engineer in charge of design and maintenance; loaned to the Koehring Division of National Equipment Corporation in 1929; returned to Portland Cement Association in 1930; in charge of the research laboratory of Pennsylvania-Dixie Corporation in 1931; chief engineer, D. M. Haering and Company from 1932 to 1933; associate engineer, Portland Cement Association, from 1933 to 1938; instructor in mechanics in the Evening Division of Armour Institute of Technology from 1936 to 1938; chairman, Department of Civil Engineering, Lewis Institute, from 1938 to 1940. Professor Shuman is a member of Tau Beta Pi, Chi Epsilon, Gamma Alpha, Triangle, Wisconsin "W" Club, Western Society of Engineers, American Society of Civil Engineers, Society for the Promotion of Engineering Education, and Society of Rheology. He has been the recipient of the Charles Ellet Award for Junior Engineers, of the Western Society of Engineers. As a member of the American Association of Engineers he was a National Director in 1936 and National Vice-President in 1937; since 1938 he has been National President.

FRANK H. WADE, Assistant Professor of Applied Mechanics, attended Michigan State College from 1904 to 1907, and graduated from

Lewis Institute with the degree of M.E. in 1909. He has taken special courses in mechanics, mathematics, and hydraulics at the University of Wisconsin. He has filled various teaching positions at Lewis, in the departments of physics and mechanics, and has been acting head of the latter department. He has been consulting engineer for Rummler and Rummler, patent attorneys, and has done a considerable amount of professional engineering work as his teaching duties afforded opportunity. Professor Wade is the author of various engineering papers, and is now engaged in preparing a textbook on Mechanics. In lighter vein, he has written *College Joe On the Slide Rule*. He is a member of Tau Beta Pi, Western Society of Engineers, Central Association of Science and Mathematics Teachers, and Society for the Promotion of Engineering Education.

LEE R. WILCOX, Assistant Professor of Mathematics, is a graduate of the University of Chicago, where he received the degrees of S.B. in 1932, S.M. in 1933, and Ph.D. in 1935. From 1935 to 1938 he was at the Institute for Advanced Study, and has served as instructor at the University of Chicago and the University of Wisconsin. His published papers have appeared in the Bulletin of the American Mathematical Society and in Annals of Mathematics. Professor Wilcox is a member of Phi Beta Kappa, Sigma Xi, and the American Mathematical Society. He has held a prize scholarship, three honor scholarships, and two fellowships.

SAUL WINSTEIN, Instructor in Chemistry, graduated from the University of California at Los Angeles in 1934, with the degree of A.B. He received his A.M. degree at the same school in 1935, and the degree of Ph.D. at the California Institute of Technology in 1938. His major field was organic chemistry. In 1938 he was an instructor at the University of California (L.A.), and during the next year was a research associate at the California Institute of Technology. From 1939 to 1940, Dr. Winstein was a National Research Fellow in Chemistry at Harvard University, the California Institute of Technology, and the University of California (L.A.). His research field is physico-organic chemistry, and he is the author of some seventeen publications on the general subjects of rearrangements, reaction mechanisms, and unsaturated compounds.

JOHN I. YELLOTT, Professor of Mechanical Engineering, and Director of the Department of Mechanical Engineering, graduated from the Johns Hopkins University in 1931, with honor, receiving the B.E. degree. After two years of graduate work with Professor A. G. Christie he received the degree of M.M.E., his thesis project involving research on supersaturated steam. He became instructor in mechanical engineering at the University of Rochester in 1933, giving courses in thermodynamics, mechanics, and machine design, as well as laboratory work. In 1934 he was appointed instructor in mechanical engineering at Stevens Institute of Technology, becoming assistant professor in 1936, and serving as chairman of the department from 1937 to 1938. His research work has been mainly in the field of high-velocity flow of steam and air.

Professor Yellott has been engaged in consulting work for the Keuffel and Esser Company, relating to slide rules, measuring tapes, power plant problems, and apprentice training; for the General Electric Company, in their steam research division; for the Republic Flow Meter Company, in problems connected with the design of high-pressure, high-temperature reducing valves; for the Worthington Pump and Machinery Company, on steamjet ejectors; and for E. J. Willis Company, on the development of small blowers for marine use, and tests of various kinds of rubber bearings.

In 1933, he presented before the American Society of Mechanical Engineers a paper entitled *Supersaturated Steam*, for which he received the Junior Award of the society. This paper was published in full by *Engineering*, London, and in condensed form by *The Engineer*, London. Other important publications are *Condensation of Flowing Steam* (jointly with C. K. Holland), (Trans. A.S.M.E.), and *Observations of Flowing Steam*, published in *Combustion*. Other publications include numerous discussions of A.S.M.E. papers on subjects relating to thermodynamics, fluid mechanics, and industrial instruments.

Professor Yellott is a member of Tau Beta Pi; Sigma Xi; Alpha Delta Phi; Omicron Delta Kappa; and the Society for the Promotion of Engineering Education. He is a junior member of the American Society of Mechanical Engineers; in 1939 he received the Pi Tau Sigma Award at the annual meeting of the A.S.M.E.

VISITORS

One of the pleasant experiences of a veteran member of the staff of a school which has itself become entitled to designation as veteran, is the frequent meeting with colleagues and of students of earlier days. We have many visitors, and we do not maintain a roster of them. Recently we have seen Victor C. Alderson and Franklin P. Adams. Dr. Alderson was dean of Armour Institute from 1901 to 1903; he left us to become president of the Colorado School of Mines. Mr. Adams, the "F.P.A." of the "Conning Tower" and "Information, Please," graduated from the old Armour Scientific Academy in 1899.

FROM YEAR TO YEAR

A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

ALUMNI BANQUET

Perhaps for the fiftieth time Armour alumni met in a formal banquet to hear of Armour affairs from Armour men. Early in the afternoon of June 4, things got under way with the opening salutation by the Class of 1915 celebrating their twenty-fifth anniversary. Congregation point in the fourth floor of the Chicago Towers Club saw old graduates meeting their friends and professors for the first time in many years. In the midst of such conviviality, time passed rapidly until the seating for the formal banquet at 6:30 p. m. Many matters important to Armour men were brought forth in the program which followed.

After a resounding cheer at the conclusion of "The Cruiser Goes Rolling Along," the more serious aspects of the evening were approached. Several routine reports were disposed of, after which the nominations for the various alumni offices were placed before the group.

J. Warren McCaffrey, Ch.E., '22, was elected the thirty-first President of the Armour Alumni Association, succeeding the venerable John J. Schommer, Ch.E., '12, who had served in this capacity for the past eleven years. Claude Albert Knuepfer, C.E. '15, on the eve of the twenty fifth anniversary of his graduation from Armour, was elected to the position of Vice President. Reelected for a second two-year term was William Nicholas Setterberg, Arch. '29, who again became Secretary-Treasurer.

Completion of the slate included election to the Board of Managers of Louis James Byrne, M.E., '04, who will represent the Classes 1902-06. John Schommer, Ch.E., '12, becomes a member of the Board, representing the Classes 1912-16. Eugene Voita, Arch., '24, was reelected for a new four-year term and represents the Classes 1922-26. Stanley M. Lind, Ch.E., '32, was elected to replace Harvey S. Rossing, C.E., '32, to represent the Classes 1932-36. To represent recent graduating classes from 1937 to the present time, Richard N. Vandekieft, M.E., '39, was elected for a two-year term. Nominations were presented by A. H. Jens, F.P.E., '31 and were submitted by a Committee on Nominations consisting of William F. Sims, E.E., '97, Chairman; Edward F. Pohlmann, Ch.E., '10; Edward J. Pleva, Ch.E., '38, James C. Peebles, E.E., '04; Robert M. Krause, M.E., '31.

To Francis Opila, C.E., '40, went the coveted Alumni-Student honor award, which is given each year to the man of the graduating class standing highest in activities and scholarship on the basis of a point system developed at the Institute. Presentation was made by Alumni President, John Schommer.

The Committee on the Alumni Service Award Key announced that no award was to be made at this time.

C. A. Knuepfer, C.E., '15, as Chairman of the Distinguished Service Award Committee announced that he was giving way to William F. Sims, E.E., '97, for announcement in connection with the presentation of this award. Mr. Sims read the following citation:

> "For outstanding contribution in many fields of endeavor and especially for his distinguished service as President of the Armour Alumni Association, for his representation as Trustee largely in alumni affairs on the Board of Trustees of Armour Institute, for his outstanding work in developing the Placement Department at Armour Institute, for his counsel and guidance as a teacher, and for his exceptional qualities of leadership, this
>
> Distinguished Service Award
>
> is presented to
>
> JOHN JOSEPH SCHOMMER
>
> Class of 1912
>
> Presented at Chicago on June 4, 1940, by a grateful and appreciative Alumni by its Board of Managers."

A tremendous ovation was afforded Mr. Schommer, and in acknowledging receipt of the Award, he was at a loss to put his feeling into words.

At the time of the banquet, the Armour Institute-Lewis merger project had not yet been consummated. Interest among the Alumni was running very high in this regard, and it was not until the Chairman of the Board of Trustees, James D. Cunningham, presented some of the lesser known facts, that a better understanding was reached. Mr. Cunningham advised that Judge Dunne had the matter under consideration, and that it would undoubtedly be some time before a decision would be rendered. However, we since know that Judge Dunne entered a decree in favor of the merger, and that the merger plans are now well under way.

One of the outstanding features of the evening was the presentation by President Henry T. Heald of facts and figures relating to the past and present of Armour Institute. Mr. Heald, with the assistance of lantern

slides, illustrated the position of the Institute of today relative to that of Armour during the past hectic years. "The problem today," said Mr. Heald, "is not one of attracting a large student body but one of keeping technical education abreast of the times." Numerous questions were put to President Heald at the conclusion of the banquet.

The question of Alumni Trustee was tabled pending a decision by the Armour Board of Trustees regarding a nominee suggested by the Alumni Association. It is understood that Mr. McCaffrey will represent the active Alumni Association on the Armour Board of Trustees until this matter can be definitely decided.

Credit should be extended to the banquet arrangement committee which did such a grand job in perfecting many of the details of the 1940 assembly. Eugene Voita, as chairman of the committee, spent many hours completing arrangements as did Messrs. McCaffrey, Schommer and Setterberg, who composed the committee. Class representatives and class chairmen are to be commended for their efforts in bringing about a successful meeting.

TWENTY-FIFTH REUNION CLASS OF 1915

Organization of the reunion party for the Class of 1915 was under the direction of a committee composed of the following men:

Stanley Moyer Peterson, Arch.; Robert Lee Wilson, Ch.E.; Claude A. Knuepfer, C.E.; Edward John Burris, E.E.; Walter Rietz, F.P.E.; Bradley Carr, I.A.; Oscar Anderson, M.E., and James Leo Mayer, M.E.

Active work was begun early in February in the hope that every man in the class would be reached and that all plans and programs could culminate on the day of the alumni banquet.

Response was widespread, with letters from Max Deitenbeck, C.E. '15, in Birmingham, Alabama; William Lindblom, C.E. '15, in Greensburg, Pa.; and from Faye N. Compton, C.E. '15, in Glendale, California. Many other letters and telegrams were received by the Committee.

Special headquarters for the reunion party were set up on the fifth floor of the Chicago Towers Club and a glad hand was extended to all who dared to enter the doorway. The salutation of the day was, "Hiya, '15. Where have ya been the last twenty-five years?"

Sitting at the reunion table were the following men who came from points as widespread as Buffalo, New York; Marshalltown, Iowa; and Albion, Michigan. ARCHITECTS: Jacob Lewis, Stanley Moyer Peterson, Ivar Roy Swanson. CHEMICALS: Curtis W. Diemecke, Joseph Romeo Lauletta, Jr., Ernst Sieck, Harry A. Strain, Robert Wilson. CIVILS: Jos. Lawrence Duffy, Leonard Hook, C. A. Knuepfer, Herman C. Nebel, Max A. Sherman, Charles Read Simmons, Geo. John Trinkaus. ELECTRICALS: John Friece Adamson, Glen Barrer, Ormond Roy Hupp. FIRE PROTECTS: Stanley Wm. Anderson, Edouard Mars Kratz, Walter Rietz. INDUSTRIAL ARTS: Bradley Sayre Carr. MECHANICALS: Jess Alvey Agee, Oscar Allen Anderson, Lyman Withrow Close, Frank Geo. Cooban, Lester Downey, Fred Lewis Faulkner, Eugene S. Harman, Lewis Edwin Hibbard, Alfred H. Johnson, James Leo Mayer, Walter Sir, Harlan Clifford Skinner, Fred L. Ward.

Ground work was laid for the formation of a committee to plan the Fiftieth Reunion of the Class of '15 in 1965. Details are to be announced at a future time.

Alumni Placement Department

Some very interesting reports have emanated from the Placement Office, which is under the able direction of John J. Schommer, Ch.E., '12. Faced with the problem of placing a group of Armour men with a wide range of experience and in practically every age group, the Department attempted to secure a personnel record for each Armour man. The returns were far from being 100 percent complete, yet these records form a nucleus for the selection of men for positions that come to the attention of the office. For recent years, practically complete records of the graduating classes have been secured.

For the year ending August 31, 1940, Armour Alumni to the number of 492 were placed in positions or were moved into positions involving more responsibility or increased salary. Four graduate students were placed in positions as were forty-eight evening division students. As a further activity, the Department secured holiday employment for many students and fifty-four summer positions for undergraduates.

The total number of graduates who are shown by our records to be unemployed in approximately six-tenths of one percent.

Good results have been obtained in placing the Class of 1940, and the placements to date are almost ninety-seven percent of the total. In five Departments, Architectural, Civil, Engineering Science, Mechanical, and Fire Protection, all of the 1940 graduates have been placed. In Chemical Engineering, thirty-five of forty graduates have been placed and in Electrical Engineering, thirty-four of thirty-five have been placed. An investigation of the records indicates an average initial salary for the Class of 1940 close to $120 per month. A large percentage of these men are placed in their own fields.

Board of Trustees Chairman James D. Cunningham presents interesting details of the merger with Lewis Institute.

Oldest alumnus Billy Sims, E.E. '97, has a chat with President Heald.

President Heald at the mike gives review of the Armour scene and the problems of engineering education in a large metropolitan area.

Left—Program for the evening being engineered by John Schommer and Alumni Editor Art Jens.

Right—Bradley Carr, I.A. '15, who was in part responsible for the '15 reunion program, headed the receiving line. Walter Sir, M.E. '15 in the background.

Banquet Photos by Paul F. Leopold, '13

Trustee E. A. Henne, Prof. J. B. Finnegan, Trustee R. B. Harper, H. A. Vagtborg, Director of Research Foundation, Dean C. A. Tibbals and Prof. P. C. Huntley.

Below, left—At the banquet table meet the silver anniversary men of 1915. From left to right: Fred Faulkner, M.E. (left rear); Bob Wilson, Ch.E.; Curt Diemecke, Ch.E.; Ernie Sieck, Ch.E.; Oscar Anderson, M.E.; Walter Sir, M. E.

Right, above—Francis Opila, C.E. '40, recipient of the Armour Alumni Association Award to the outstanding graduate of the Class of 1940.

Ed Sincere, Arch. '15, discusses weighty problems of the day with Eugene Voita, Arch. '25. In the background is Bill Setterberg, Arch. '29, and Al Schreiber, Ch.E. '37

John Adamson, E.E. '15, extends the glad hand to Walter Rietz, F.P.E. '15, and "String" Knuepfer, C.E. '15.

1897

O'Brien, Francis Thomas, E.E., is now residing at 6211 Magnolia Ave., Chicago.

Wheeler, John Jones, M.E., has recently changed his address to 1137 W. 35th Pl., Los Angeles, Calif.

1899

White, Ernest Castelo, M.E., who is President of The Ansonia Clock Co., has recently changed his address to 328 Pondfield Road, Bronxville, N. Y.

1901

Swift, John Burnett, E.E., is now residing at Towers Hotel, 332 S.E. 2nd Ave., Miami, Florida.

1904

Wickersham, Edward James, M.E., who is Mechanical Engineer, Heat & Fuel Engineering Co., is now residing at 9200 Loomis, Chicago.

1906

Becker, Albert D., Arch., who is Secretary of the Homestake Oil Co., is now residing at 1901 9th Street, Columbus, Nebraska.

Klapper, Charles, E.E., who is in the Construction Dept. PWA, is now residing at 1851 North Damen Avenue, Chicago.

1907

Wachs, Theodore, M.E., who is Plant Engineer, R. C. A. Mfg. Co., has recently moved to 337 King's Highway, West, Haddonfield, N. J.

1908

Pollock, Ernest, C.E., who is Partner in The Tetra Co., has recently changed his address to 6180 South Cornell Avenue, Chicago.

1909

Ford, Thomas Cecil, Ch.E., who is Superintendent American Asphalt Paint Co., is now residing at 1319 Cobb Blvd., Kankakee, Illinois.

Harvey, James S., M.E., has recently changed his address to 822 Madison St., Evanston, Illinois.

McKarahan, Elmer Verne, F.P.E., is now residing at 657 Neff Road, Detroit, Mich.

Uhlendorf, Edward D., C.E., Executive Engineer for the Public Utility Engineering & Service Corp., is now residing at 5555 Sheridan Rd., Chicago.

1910

Liebenstein, Harold E., C.E., who is a Salesman for Hallgarten & Co., has recently changed his address to 231 S. LaSalle St., Chicago.

Whitmore, Ray, E.E., who is Electrical Tester, Cutler Hammer, Inc., is now residing at 1226 Rawson, South Milwaukee, Wisc.

1911

Emmons, Gilbert C., E.E., who is a Consulting Engineer for the Commercial Testing & Engineering Co., has recently changed his address to 321 N. Elmwood Avenue, Oak Park, Ill.

Sackheim, Sol, E.E., who is a Mathematics Teacher at the Roosevelt High School, has recently moved to 1633 Fargo, Chicago.

Stevens, Wier A., C.E., has recently moved to 28 Academy Street, Greenwich, N. Y.

1912

Meade, G. Raymond, E.E., who is a Valuation Engineer with the Illinois Commerce Commission, is now residing at 1924 Washington Blvd., Chicago.

1913

Schreiber, John A., M.E., who is Secretary and General Manager for Hamlins Wizard Oil Co., has recently changed his address to Oak Crest Hotel, Evanston, Illinois.

1915

Burris, Edward John, E.E., who is Sales Representative for the Illinois Electric Porcelain Co., has recently changed his address to 1214 North Laramie Avenue, Chicago.

Marx, Emmet R., C.E., has written several very interesting letters to Claude A. Knuepfer, C.E., '15, in connection with the twenty-fifth anniversary of his graduation from Armour. Excerpts from his letters follow:

"I am going to be strongly tempted to trek back to Chicago for that June fourth reunion, and have impounded a road stake for that purpose, but other conditions have got to be exceedingly propitious. You see, Claude, I can't get around like I could used to. I have just got home from a month in the hospital where I have been trying to get rid of an abscess in my back, and the effects haven't all passed off yet. Right now I feel like that guy that the ribald poet wrote about in verse 28 of "The Armour Y.M.C.A.", — — "a physical wreck from Armour Tech, a heck of an engineer." But I believe I am on the upgrade.

"I suppose John Jucker (C.E. '15) or somebody, has told you that I got kind of messed up two years ago. I grounded 14,000 volts off a transmission line concealed in the trees on a mountain side, using a 500-foot surveyor's tape and my body. I still run a surveying crew, however, and hobble around after them using artificial limbs and a cane, except where the going is too rough. And in the office I draw with the pencil between the middle fingers because the thumb and forefinger are gone as well as some of the fingers on the other hand. But life is sweet and interesting, as it always was, if not more so."

On May 28, 1940, Mr. Marx wrote to Mr. Knuepfer in part as follows:

"It was nice of you to answer my letter and tell me a little more about yourself. I have read the roster several times. It appears that the class of 1915 has done well. I am proud of the fact that practically all are industrialists and have kept their noses out of the public feed bag, which is going some, for engineers. And I am especially proud of you few who have become economic royalists.

"That proved to be a pipe dream of mine, what I said about attending the twenty-fifth reunion. I told my surgeon I wanted to do that. He agreed that would be nice, but, as for me, I should stay in his ward on my back for three months if I entertained any desire for future circulation.

"However, four walls do not a prison make. This Vets' hospital is a palace, and I have a private cell. And the nurses aren't *all* hags. People, including my wife and sons, come in to see me. I read and write and listen to the radio.

"I hope the reunion is a smashing success. Please remember me to the boys, and especially to Harold E. Anning (C.E. '16), my wastrel twin of other days whom I kept out of Tau Beta Pi; and John Jucker Jr., the fellow with the black hair on his cheek bones; and that thin-skinned and thick-gutted Irishman, Joseph L. Duffy (C.E. '15); and Herman C. the rent from my next door neighbors at Kremlin. I wish I could be present in person to exchange insults with these gentlemen.

As ever,

Emmet R. Marx"

Armour men who knew Emmet Marx will undoubtedly be sorry to learn of his unfortunate accident in grounding 14,000 volts. He may be reached at 2025 East Third Street, Tucson, Arizona, and letters from his old classmates would be most appreciated.

Sieck, Ernst, Ch.E., who is Chemist, Sieck & Drucker, has recently moved to 1810 N. Winchester, Chicago.

1916

Altman, Eugene Emanuel, Ch.E., who is with Felton & Son, Inc., has recently moved to 6550 North Ashland Ave., Chicago.

Foy, Edgar Allanson, C.E., who is now with the Bureau of Yards & Docks, Naval Air Station, Pensacola, Florida, is residing at 138 North M Street, Pensacola, Florida.

Mann, Estes W., Arch., was erroneously reported to have changed his address to 1616 Walnut Street, Philadelphia in the May issue of the *Armour Engineer and Alumnus*. In his letter of June 4th, Mr. Mann advises the Alumni Editor that he " . . . was quite surprised to read where I had changed my address . . . since I have been located in Memphis twenty-two years and still pay rent on my office here at 967 Shrine Building. . ."

Mann is still President and Treasurer of Estes W. Mann, Architect, Inc. and is also President and Treasurer of Estes W. Mann & Company, Architects and Engineers, with offices in Greenville, Mississippi.

His home residence is 2190 South Parkway east, Memphis, Tennessee where he has, " . . . a wife and two sons to look after me. . ."

Sullivan, Joseph Edwards, C.E., has recently moved to 421-A South Taylor Ave., Oak Park, Illinois.

1917

Hall, Kenneth Vetter, F.P.E., who has conducted his own insurance agency, is now a member of the inspection staff of the Indiana Inspection Bureau and is located in Indianapolis.

1918

Broyles, John Lewis, E.E., who is with the Economy Fuse & Mfg. Co., has recently changed his address to 5759 N. Rockwell, Chicago.

Hadley, Orren L., Jr., Ch.E., who is Chief Chemist for the Lone Star Cement Corp. is now residing at 4206 Gilbert, Dallas, Tex.

1919

Joslyn, Raymond Oliver, E.E., who is President of the Layne-Western Co., has recently moved to 1010 W. 39th Street, Kansas City, Mo.

La Zoris, Alexander S., Ch.E., may be reached at Box 153, Oak Park, Ill.

Wilbor, John Borden, Ch.E., who is Director and Assistant to President of Wadhams Oil Co., has recently changed his address to 1880 Groveland Ave., Highland Park, Ill.

Winfield, Raymond B., C.E., who is Sales Manager, S. W. Nichols Co., is now residing at 1605 N.B.C. Bldg., Cleveland, Ohio.

1920

Anderson, Homer Ellery, C.E., who is with the New York Life Insurance Co., is now residing at 775 Post Street, San Francisco, California.

Gottlieb, Marshall Daniel, M.E., who is the owner of the M. Gottlieb & Co., has recently moved to the Embassy Hotel, Chicago.

Lewis, Benjamin Wolf, Ch.E., who is Salesman for Wishnick-Tumpeer, Inc., has recently changed his address to 5111 East View Park, Chicago.

1921

MARANZ, LEO S., M.E., who is Sales Manager, Tuthill Pump Co., is now residing at 1910 East End Ave., Chicago, Ill.

1922

FULTZ, HARRY T., Ind. Arts, who is State Director, WPA Adult Education Program, recently moved to 6736 Dorchester Ave., Chicago.

KUEHN, OTTO, M.E., who is an Automotive Engineer, Standard Oil Co., is now residing at 5710 N. Rockwell Street, Chicago.

OLSEN, MARVIN R., M.E., who is Development Engineer for Sears Roebuck & Co., has recently moved to 469 Hawthorne Ave., Glen Ellyn, Ill.

SLOAN, ARTHUR H., E.E., who is a Salesman for Williams Oil-O-Matic Heating Corp., has recently moved to 6646 Stony Island, Chicago.

WITTENMEIER, FRED G., M.E., who is Chief Engineer for Wittenmeier Machinery Co., is now residing at 4444 N. Wolcott, Chicago.

1923

FREDERICK, FRED G., C.E., who is Assistant Engineer with the Indiana Harbor Belt R.R., has recently changed his address to 4410 Drexel Blvd.

SLOAN, JOSEPH S., M.E., who is a salesman for DuBois Co., has recently changed his address to 5305 Hyde Park, Chicago.

SMITH, ORMAS G., C.E., who is Engineer of Buildings, Illinois Bell Telephone Co., is now residing at 6154 North Campbell Avenue, Chicago.

SPECTOR, MORRIS, E.E., who is a Patent Attorney, has recently changed his address to 7710 Colfax Avenue, Chicago.

1924

BLAUFUSS, WILLIAM B., M.E., who is with the American Potash & Chemical Corp., has recently moved to 1210 Tosca Road, Girard, Calif.

BRANDT, ROBERT L., Arch., who is a Partner of Alexander & Brandt, has recently changed his address to 5330 Harrison Street, Chicago.

BROSTOFF, HARRY M., C.E., has recently moved to 5009 Sheridan Road.

DRUBECK, MAURICE ALLEN, M.E., who is a Designing Engineer for the Water Purification Dept., now resides at 69 E. Cedar Street, Chicago.

EIDENBERG, HENRY, M.E., who is the Owner of the General Store Fixture Co., has recently changed his address to 5453 Greenview Avenue, Chicago.

KAEHLER, ARTHUR W., Ch.E., who is a Chemist for the Chicago Extruded Metals Co., has recently changed his address to 510 Wrightwood, Chicago, Illinois.

McDOWELL, THOMAS E., E.E., who is Chief Engineer for the Pyle National Co., has recently moved to 1010 No. Grove Ave., Oak Park, Ill.

RANSON, RICHARD R., E.E., who is Electrical Engineer with Cutler Hammer, Inc., is now residing at 4951 N. Newhall St., Milwaukee, Wisc.

SANBORN, EARL R., F.P.E., was recently made Superintendent of Agents for the Great American Group of Insurance Cos. No territory has been assigned but his duties will include supervision of the Engineering Department.

SOLOMON, HARRY, C.E., who is a Structural Engineer for Roberts & Schaefer, is now residing at 5141 N. Central Park Avenue, Chicago.

TERRY, EUGENE J., F.P.E., is now a member of the staff of the Insurance Commissioner's office of the State of Wisconsin. It is understood he will have particular charge of the State Fund Insurance Department. Terry has been con-

CLASSIFIED ADVERTISEMENTS

tinuously connected with the Wisconsin Fire Insurance Rating Bureau since 1924 and recently did service work in the west portion of Milwaukee.

VOLBERDING, FRED F., F.P.E., who is Inspector with the Chicago Board of Underwriters, is now residing at 2444 Campbell, Chicago.

WALWORTH, RICHARD HENRY, M.E., who is with the Thompson Products Co., has recently changed his address to 1930 Fleetwood, Detroit, Mich.

1925

BISHOP, CLIVE R., E.E., who is Assistant Advertising Manager for the Public Service Co., is now residing at 1020 Hull Terrace, Evanston, Ill.

FREDERICK, JOHN R., E.E., who is an Industrial Engineer with the Wisconsin Power & Light Co., is now residing at 2650 Chamberlain St., Madison, Wisc.

FRISCH, JOSEPH P., C.E., who is President of the Frisch Corp. recently changed his address to 539 Melrose, Kenilworth, Ill.

GREEN, LOUIS SPENCER, F.P.E., who is an inspector for the Missouri Inspection Bureau, recently changed his address to 607 W. 37th Street, Kansas City, Missouri.

SMITH, ROBERT A., JR., Arch., who is with the American Sash & Door Co., has recently changed his address to Sta. B. Box 4357, Kansas City, Missouri.

WILSON, HARRISON D., JR., E.E., who is Distribution Engineer, Chicago Rapid Transit Co., has recently moved to 4655 Lake Park Ave., Chicago.

1926

BERMAN, WILLIAM, Ch.E., who is a Chemical Engineer for Cuneo Press, has recently changed his address to 6440 No. Claremont St., Chicago.

BROCK A. GALT, M.E., who is Operations Manager of Arthur Rubloff & Co., is now residing at 1254 Lake Shore Drive, Chicago.

GORDER, LESLIE O., E.E., who is Associate Professor, Chicago Technical College, is now residing at 4013 Greenview Avenue, Chicago.

HUSSANDER, MARTIN CLARENCE, M.E., who is Secretary-Treasurer, Albin J. Liepold, Inc. is now residing at 1526 Washington Ave., Wilmette, Ill.

NEMOEDE, PAUL AUGUST, M.E., who is an Estimator, Container Corp. of America has recently changed his address to 26 Waldemar Drive, Willoughby, Ohio.

STIEHL, DOUGLAS R., M.E., who is District Sales Manager, The B. F. Sturtevant Co., is now residing at 244 Ninth Street, San Francisco, Calif.

TREFF, WALTER R., Arch., may be reached at P.O. Box 442, Silver Lake, Wisc.

1927

ALLAIRE, LOUIS P., F.P.E., who is an Engineer for the Fireman's Fund Insurance Co., is now residing at 4202 North Drexel, Indianapolis, Indiana.

DEAN, HARRY F., C.E., who is a Draftsman in the U. S. Engineer Office, recently moved to 634 Gorsuch Ave., Baltimore, Md.

FLYNN, FRANCIS WILLIAM, E.E., who is a Teacher, Chicago Board of Education, has recently moved to 8009 W. Wood, Chicago.

KENT, JAMES W., F.P.E., is now Special Agent for the National Insurance Co. of Hartford with headquarters in Kansas City, Missouri. He will handle the entire State of Missouri. Kent has recently been in charge of the Springfield office of the Missouri Inspection Bureau where it is understood he did an outstanding job.

LORU, FREDERIC W., E.E., who is in the Financial Research division of Spiegel,

Inc., has recently moved to 6811 Paxton Avenue, Chicago.

Lukey, J. Gerald, E.E., who is Assistant Power Supervisor, Public Service Co., has recently changed his address to P. O. Box 512, Northbrook, Illinois.

Marlow, Nicholas H., M.E., who is an Instructor in Mechanical Drawing at Schurz High School, has recently changed his address to 4109 N. Kedvale Avenue, Chicago.

Mazzone, Samuel A., Arch., who is a Draftsman with S. A. Marx, Architect, is now residing at 205 Oak Street, Elmhurst, Ill.

Ross, Harold E., M.E., who is an Engineer for Carrier Corp., has recently moved to 1234 N. Wovde St., Sherman, Texas.

St. Clair, Charles Truman, Arch., has recently changed his address to 1390 Birch Street, Denver, Colo.

Seeley, Clarence H., Ch. E., who is a Patent Solicitor for the Standard Oil Co., has recently changed his address to 9343 S. Ada Street, Chicago.

Stahl, Elmer W., E.E., who is a Research Engineer, Crane Co., is now residing at 7814 Michigan Avenue, Chicago.

1928

Dahlgren, Harold Thorwald, E.E., who is Chief of Manufacturing Development for the Teletype Corp., is now residing at 427 Cumberland Ave., Park Ridge, Illinois.

Higgins, Edgar James, Arch., who is Secretary and Treasurer, Reed & Higgins, Inc., has recently moved to 6238 Forest Avenue, Hammond, Indiana.

Johnson, Halvard T., F.P.E., who is with the Illinois Inspection Bureau, is now residing at 5621 Emerald, Chicago.

Kramer, Leroy A., Ch.E., who is with the Victor Chemical Co., has moved to 380 W. 16th St., Chicago Heights, Ill.

Macy, Kent L., F.P.E., who is Special Agent for America Fore Insurance & Indemnity Group is now residing at 7 North Meridian Street, Indianapolis, Indiana.

Payne, Frederick David, F.P.E., is now Special Agent for the New York Underwriters Insurance Co. with headquarters in Indianapolis. He will cover the Indiana field doing both engineering and general agency work. When Payne was graduated from Armour he went with the Wisconsin Fire Insurance Rating Bureau where he gained valuable experience in rating and engineering matters. In 1930 he was transferred to the Indiana Inspection Bureau where for several years he has done engineering work in the Indianapolis area. Outside of his very major interest in his family he has done some amateur gardening and has taken an active part in the Signal Corps of the Indiana National Guard.

Smethells, John M., F.P.E., has been appointed Special Agent for the Detroit Fire and Marine Insurance Co. to cover territory immediately surrounding Detroit. Jack has been with the Michigan Inspection Bureau since his graduation from Armour.

1929

Forss, Fritz Victor, E.E., who is with the Independent Pneumatic Tool Co., recently moved to 512 Bangs Street, Aurora, Illinois.

Gerstel, Leonard, E.E., Member E. M. Gerstel & Co., is now residing at 4721 Drexel Blvd., Chicago, Ill.

Juergenson, Fred Henry, E.E., who is Electrical Engineer American Telephone & Telegraph Co., is now residing at 475 Montrose, Elmhurst, Ill.

McDonald, Norman, M.E., Owner of Norman McDonald & Co., is now residing at 2516 Green Bay Road, Evanston, Ill.

Miles, Karl Walker, E.E., has recently moved to 811 N. Harvey Avenue, Oak Park, Ill.

Miller, Allen, C.E., who is Resident Engineer, Cook County Highway Dept., has recently changed his address to 311 N. Gale, River Forest, Illinois.

Mullins, Wilbur Aaron, Arch., who is a Partner of Latz & Mullin, has recently moved to 1506 70th St., Kenosha, Wisconsin.

Setterberg, William Nicholas, Arch., who is Registrar of the Evening Division at Armour, is now residing at 8136 Lafayette Avenue, Chicago.

Shabino, Clarke L., C.E., who is with the General Electric Co., is now residing at 1602 Hinman Ave., Evanston, Ill.

1930

Beatty, Stanley Allan, F.P.E., has recently moved to 6036 Ingleside Ave., Chicago, Illinois.

Carlson, Clarence L., M.E., who is a Salesman for W. P. Nevins Co., is now residing at 1310 Lunt Avenue, Chicago.

Guenther, Alfred Charles, F.P.E., has been appointed State Agent for the National Fire Group of Insurance Cos. in Minnesota. He has been Special Agent for the same companies working Ohio from headquarters in Columbus.

Lossman, Joseph Richard, F.P.E., is now a Special Representative for the Oil Insurance Association with headquarters at Tulsa, Okla. After leaving Armour, Lossman went with the Ohio Inspection Bureau and for the past three years has been an engineer with the Pearl-American fleet of Insurance Cos.

Meyer, Martin, Arch., who is with Lloyds Property Owners Assn., is now residing at 3512½ Pine Grove, Chicago.

Mueller, Arthur John, Ch.E., who is with Ford Hopkins Co., is now residing at 5029 N. Major Avenue, Chicago.

Mullins, Harley Willard, F.P.E., who is with National Fire Insurance Co., has recently moved to 256 Buckingham Drive, Indianapolis, Ind.

Paul, Donald Joseph, F.P.E., is now residing at 16039 Chalfonte, Detroit, Mich.

Rose, James J., C.E., has recently changed his address to DeLuxe Camp, Las Animas, Colo.

West, Russell A., C.E., who is Special Engineer with Carnegie Illinois Steel Co., has recently moved to 7816 Saginaw Ave., Chicago.

Zimmermann, Frank Otto, E.E., who is a Salesman, Westinghouse Electric Elevator Co., has recently changed his address to 127 N. Humphrey Ave., Oak Park, Ill.

1931

Arazoris, Vito J., M.E., who is an Engineer of furniture designing for the National Mineral Company, has recently changed his address to 2638 North Pulaski Road, Chicago.

Booker, LeRoy W., F.P.E., who is Sales Secretary for National Oil Line Ins. Co., has recently moved to 2601 N. Filmore St., Little Rock, Arkansas.

Drell, Isadore L., Ch.E., who is with the Clough Brengle Co., recently changed his address to 5111 S. Woodlawn Ave., Chicago, Illinois.

Fiala, Oliver J., Ch.E., who is Technical Director, Durkee Famous Foods, has recently moved to 2101 Baringer Ave., Louisville, Kentucky.

Hausner, William L., C.E., who is Sales Engineer for Wallace & Tiernan Co., has recently moved to 729 Princeton Avenue, Highland Park, Ill.

Hartanov, Andrew S., M.E., who is an Experimental Engineer with Swift & Co., is now residing at 11219 Eggleston Ave., Chicago.

Holt, Harmon S., F.P.E., has recently changed his address to 722 Taylor Street, Topeka, Kansas.

Kellner, Richard Gustav, E.E., is now residing at 5803 W. Erie Street, Chicago.

Krause, Robert Mortimer, M.E., who is Chief Engineer, Coated Board Division, Container Corp. of America, is now residing at 17836 Dixie Highway, Homewood, Illinois.

Langhammer, Kenneth C., F.P.E., is proud to announce the arrival of a second boy to the Indianapolis home of the Langhammers. Date: March 21, 1940. Name: Clemment Dale.

Latham, Harold J., Ch.E., who is Junior Engineer, The Peoples Gas Light & Coke Co., has recently moved to 7851 N. Kolmar Ave., Niles Center, Ill.

Rimmkel, Hugo, Ch.E., who is with Joseph E. Seagrams & Sons, is now residing at 154 Tebbs, Lawrenceberg, Ind.

Schrader, William A., E.E., is now with the Civil Aeronautics Authority and is residing at Castleton Court, Oceanside, Long Island, N. Y.

Seidelmann, Paul Emil, F.P.E., who is with the Ohio Inspection Bureau, has recently changed his address to 2212 Drex Ave., Norwood, Ohio.

Spalding, Frank W., F.P.E., who is an Inspector for the Illinois Inspection Bureau, has recently moved to 1511 Ridge Ave., Rockford, Ill.

Steinert, Reynold, Ch.E., has recently changed his address to c/o Nic. L. J. Van Haaren, Casilla De Correo 579, Buenos Aires, Argentina. He is still with Reichhold Chemicals, Inc.

Westerman, Claude Mason, F.P.E., who is a Field Representative with Lansing B. Warner, Inc., is now residing at 15323 Edgewater Drive, Cleveland, Ohio.

Winkler, William P., F.P.E., who has been located in the Des Moines office of the Iowa Insurance Service Bureau since his graduation from Armour is now Special Agent in Eastern Iowa for the National Fire Insurance Co. with headquarters in Des Moines.

1931 in '41—Tenth Reunion

Watch for special announcements concerning the biggest Tenth Anniversary party in the history of Armour. Plans are already under way to make Alumni week of 1941 the biggest day in all class history. A partial committee, composed of E. A. Johnson, C.E., R. M. Krause, M.E., E. E. Paschke, E.E., E. P. Holin, Arch., A. J. Lenke, F.P.E., and Art Jens, the Alumni Editor, have already done preliminary work in deciding upon a plan of attack. Questions, comments, suggestions and ideas should be directed to Tenth Reunion Committee, Class of 1931, Alumni Office, Armour Institute.

1932

Brehm, Walter C., E.E., has recently moved to 1213 N. Newhall, Shorewood, Milwaukee, Wisconsin.

Carlson, Edward William, E.E., may be reached at P. O. Box 1988, Chicago.

Casey, James Joseph, C.E., who is with the Illinois Division of Highways, has recently moved to Mundelein, Illinois.

Cornwell, David R. L., M.E., is now residing at 506 N. Cuyler Avenue, Oak Park, Illinois.

Elman, Julius, Arch., who is an Engineer in the Structural Dept. of Universal Oil Products Co., is now residing at 304 N. Wilcox, Joliet, Ill.

Finnegan, Joseph Bernard, Jr., F.P.E., who is a Special Agent for Crum & Forster, has recently been transferred to Detroit to handle Wayne County. His office is 1114 Detroit Savings Bank Building. His residence is 12055 Monica Ave., Detroit.

McCall, James Stuart, M.E., who is Assistant Engineer of Design and Material, Union Pacific R. R., has recently moved to 5616 Briggs St., Omaha, Nebraska.

McGill, Thomas Alan, E.E., who is Service Engineer, Cline Elec. Mfg. Co., has recently changed his address to 398 W. 14th Pl., Glen Ellyn, Ill.

Richards, Eugene B., E.E., who is a Statistician at the Western Electric Co., recently moved to 157 N. La Porte Ave., Chicago, Ill.

Rudolf, Wilbur Harvey, C.E., who is a Bridge Draftsman for the Atchison, Topeka & Santa Fe R. R., is now residing at 37 Tuttle Ave., Clarendon Hills, Ill.

Schodde, Glen William, F.P.E., is proud to announce the arrival of Karen Ann Schodde on June 24, 1940, in Minneapolis.

Schultz, William G., F.P.E., who has been in the Toledo office of the Ohio Inspection Bureau, has joined the staff of the Lumbermen's Mutual Insurance Co., of Mansfield, Ohio.

Stocklin, William A., E.E., who is an Engineer for Warwick Mfg. Co., has recently changed his address to 3528 N. Kilpatrick, Chicago.

Tonsager, Howard Arthur, Arch., who is Superintendent of Construction, Schmidt, Garden & Erikson, is now residing at 6431 North California Ave., Chicago.

White, Dan L., M.E., who is now with the Athey Truss Wheel Co., Clearing, Illinois, resides at 319 Ruby, Clarendon Hills.

1933

Becker, Henry F., Jr., F.P.E., is now a member of the Engineering Staff of the American Mutual Liability Insurance Co., with headquarters at 221 N. La Salle Street in Chicago. After a short training course he will be assigned to a territory outside of Chicago. Becker spent several years with the Iowa Insurance Service Bureau after which he joined the staff of Lansing B. Warner, Inc., in Chicago, as an engineer and underwriter.

Belford, Robert O., F.P.E., is now Minnesota State Agent for the Pacific National Fire Insurance Co. He was formerly an inspector with the Fire Underwriters Inspection Bureau in Minneapolis.

Bodinson, Harold William, F.P.E., who is with the Kentucky Actuarial Bureau, is now residing at Ashland, Kentucky.

Carlstrom, Roy William, F.P.E., who is Special Agent, The American Insurance Co., has recently moved to 1107 State St., Eau Clair, Wisconsin.

Larson, Bradford, F.P.E., was married on August 28, 1940, to Betty Georgine Heath in Kansas City. Their residence is 15 Colliston Road, Boston, Mass.

Lomasney, Edmund P., Ch.E., who is Chief Chemist, Red River Refining Co., is now residing at 2416 Bryn Mawr Ave., Chicago.

Reynolds, Harold Clyde, E.E., has recently moved to 1410 N. Winchester Ave., Chicago.

1934

Bachner, John Joseph, Ch.E., who is Sales Engineer for the Chicago Molded Products Corp., now resides at 1520 Park Avenue, River Forest, Illinois.

Clarkson, Clarence W., E.E., who is in the Engineering Department of the Belson Mfg. Co., recently moved to Pentwater, Michigan.

Finlay, Samuel, M.E., who is with Armour and Company, is now residing at 7223 Vincennes, Chicago.

Hofmeester, Theodoras Marinus, Jr., Arch., is now residing at 220 South Michigan Ave., c/o Cliff Dwellers, Chicago, Illinois.

Kubicka, Joseph Louis, Ch.E., who is Chief Chemist, Container Corp., has recently changed his address to 2912 Menard, Chicago, Illinois.

Kostenko, Barry Michael, C.E., who is Technical Associate, Sueske Brass & Copper Co., has recently changed his address to 2233 Buckingham Terrace, Westchester, Ill.

Lippincott, Carl M., C.E., who is Sales Engineer, Metal & Thermit Corp., is now residing at 7752 Prairie, Chicago.

Pinkus, Jerome R., M.E., who is with the Research Dept. of Crane Co., is now residing at 1011 S. Austin Blvd., Chicago.

Suman, Robert Wheeler, M.E., who is Mechanical Engineer for the Link Belt Co., has recently moved to 324 N. Mayfield, Chicago.

Thomas, Curtis William, M.E., who is with the Chicago Screw Company, has recently moved to 1841 Thomas Street, Chicago.

1935

Bolton, Howard Theodore, C.E., who is a Junior Engineer in the U. S. Engineer's office doing design work and checking flood control works is now located in Tulsa, Okla. His address is 47 N. Knoxville Ave.

Christoph, Albert Eldred, M.E., who is with Swift & Company, has recently changed his address to 339 W. Madison, Wheaton, Ill.

Cox, Harold Edward, M.E., who is Sales Engineer of the H. H. Robertson Co., has recently changed his address to 17 Brampton Lane, Green Hill, Cincinnati, Ohio.

DeLang, Theodore George, Ch.E., who is with the Featheredge Rubber Co., has recently moved to 3-West 915 Washington, Evanston, Illinois.

Grossman, Melvin, Arch., has recently changed his address to Bancroft Hotel, 15th and Collins Ave., Miami Beach, Florida.

Nelson, George Albert, C.E., is with the U. S. Engineers and is located at Diablo Heights, Canal Zone.

Stocking, Kenneth Orin, C.E., who is located in the U. S. Engineer's office in Omaha, was recently married to a Wisconsin girl.

Uzunaris, Walter Martin, E.E., who is Motor Inspector, International Harvester Co., has recently changed his address to 10151 State Street, Chicago.

West, George Anthony, C.E., who is Junior Lubrication Engineer, Standard Oil Company, is now residing at 5831 N. Washtenaw, Chicago.

1936

Allen, Jack, Arch., has recently changed his address to Corbin Place, N.E. c/o Sam Eskin, Washington, D. C.

Greenman, Hugh Merrill, M.E., who is a Production Time Clerk, Woodward Governor Co., is now residing at 1607 Crosby St., Rockford, Illinois.

Kirsch, Earl J., E.E., is now with the Standard Transformer Company at Warren, Ohio. His address is 1030 Trumbull Avenue, S.E., Warren, Ohio.

Kreft, Earl Albert, Ch.E., who is with the Portland Cement Company, has recently moved to Ingleside, Illinois.

McMullen, Edward Acie, C.E., who is an Engineer in Illinois Division of Highways, has recently changed his address to 2608 Orchard Street, Chicago, Illinois.

Neal, Donald John, F.P.E., who has been in the Engineering Department of the National Fire Insurance Co. in Chicago has been transferred to Ohio as Special Agent and Production Engineer. His headquarters will be at Columbus.

Paulsen, Robert Marshall, Ch.E., who is Research Engineer, North Shore Coke & Chemical Co. has recently changed his address to 1611 Lunt Ave., Apt. 3-N, Chicago, Ill.

Rothschild, Gilbert Robert, E.E., who is an Electrical Testing Engineer with the Electromotive Corp. has recently changed his address to 1709 E. 68th Street, Chicago.

Ruppert, Robert Beattie, E.E., F.P.E., has resigned his position as inspector with the Ohio Inspection Bureau to join the Chicago Engineering Department of the America Fore Group of Insurance Cos. His home address is 6632 Stewart Ave.

Sirr, Frederick Jos., Jr., E.E., who is an Inspector with Western Electric Co., is now residing at 5348 Oakdale, Chicago.

Smith, Frederick Arthur, C.E., who is a Draftsman for the Chicago Park District, has recently changed his address to 7401 Clyde Avenue, Chicago.

Zwissler, Gordon Arthur, C.E., who is Industrial Engineer, Carnegie-Illinois Steel Co., has recently moved to 336 Normal Parkway, Chicago.

1937

Dreis, Arthur George, Ch.E., who is with the Hercules Powder Co., is now residing at 5241 No. La Crosse, Chicago, Ill.

Mandelowitz, Abe, M.E., has recently moved to 15 N. Mayfield Avenue, Chicago, Ill.

Niemann, Reinhart, F., M.E., has recently changed his address to R.F.D. Clearing, Ill.

Ross, Herman Milton, C.E., who is a Traffic Analyst for the Illinois State Highway Dept., is now residing at 3430 West Monroe, Chicago.

Schreiber, Warren Frank, Ch.E., who is in the Research Laboratory, Gulf Research & Development Co., has recently moved to 4125 Belleplaine Ave., Chicago.

Sturgeon, John Frederick, Ch.E., who is a Chemist for E. I. Du Pont de Nemours & Co., is now residing at 1701 Granville Avenue, Chicago.

Thunder, Ivan D'Alton, C.E., may be reached c/o Shaw & Lunt, 1438 Park Street, Alameda, Calif.

Westerman, Francis George, F.P.E., who is with Lansing B. Warner, Inc., has recently changed his address to 8011 S. Eberhart Ave., Chicago.

1938

Baker, David, Arch., has recently moved to 6121 Champlain Ave., Chicago.

Deuter, Carleton Harry, Ch.E., who is with the Sherwin-Williams Paint Company, has recently moved to 10050 Claremont, Chicago.

Laber, Morton E., Ch.E., F.P.E., is an Inspector with the Indiana Inspection Bureau, assigned to the Terre Haute office in the Merchants National Bank Building, Terre Haute, Indiana. His residence is the Y. M. C. A.

McIntyre, John Forney, F.P.E., who is an Engineer with Federal Hardware & Implement Mutuals, has recently moved to Brunswick, Missouri.

Palka, George August, E.E., is now connected with the Standard Transformer Co. of Warren, Ohio and is residing at 1030 Trumbull Ave. S.E., Warren, Ohio.

Wagner, Edward, Ch.E., who is with the Standard Oil Co. of Ohio was married on August 31, 1940.

Wandmayer, Victor G., Arch. who is a Draftsman, Celotex Corp., is now residing at 902 Winona Ave., South Chicago.

1939

Collier, Thomas, C.E., who is with the Universal Cement Co. was married on July 4, 1940.

Jaffee, Robert I., Ch.E., wrote in part to Placement Director, John Schommer, on May 8, 1940, as follows:

Dear Mr. Schommer:

I have just received your kind letter of May 6 in which you informed me of your efforts to place me as a metallurgist in the Chicago area. I certainly am grateful for the active interest which you have taken in this matter.

Recently, however, I accepted a position as a Bureau of Mines Research Fellow. It really is a grand opportunity, one which I can't afford to refuse. Accordingly, I will not be able to follow the lead which you mentioned in your letter.

I will be with the Eastern Experiment Station at College Park, Maryland during the academic year, where I will do thesis work. This, coupled with course work at the University of Maryland, will lead to a Ph.D. in Chemical Engineering. Incidentally, the thesis problem is metallurgical, so I won't have entirely left the field. During the summer I'll work at the Metallurgical Station at Salt Lake City under Dr. R. S. Dean; at College Park, during the academic year, I'll work under Dr. V. H. Gottschalk.

Thanking you again for your kindness, I am

Sincerely yours,
Robert I. Jaffee
Hamilton Hall C-33

Kruse, Willard E., Ch.E., who is with the Standard Oil Co. of Indiana and is located at Whiting, Indiana was married on June 29, 1940.

Lyckberg, Berndt K., Ch.E., was married on June 15, 1940. He is with the Standard Oil Co. of Indiana.

Ryan, William A., Ch.E. It was with the deepest regret that the Alumni Office learned of the death of William Ryan who was graduated with the Class of 1939 in the Department of Chemical Engineering. He was drowned at Ypsilanti, Michigan on July 22, 1940. He was on the staff of the Peoples Gas Light and Coke Co. in Chicago.

PLUMBING

(From page 15)

hotels and other buildings throughout the city, by special permission of the Mayor and City Council granted at the request of the Health Department. Wherever any kind of hazards to life and health were found, prompt removal of the dangers followed. As the result, Chicago has set an example which is now being followed in many other cities and towns.

It is believed that today Chicago is one of the safest cities in the world as far as diseases spread through faulty plumbing are concerned, because this work has been followed up consistently for the past seven years. Other factors also have contributed their share to this great improvement. For example, the Health Department has carried on a great deal of original research and experimentation to determine whether or not various types of fixtures and devices have elements of danger and, if so, what can be done about making them safe without undue expense to the public and owners of property. Numerous exhibits have been shown for educational purposes at medical and public health meetings, as for example at the Annual Convention of the American Medical Society at Cleveland in 1934. Fixtures peculiar to hospitals and laboratories have come in for their share of attention, because of the special hazards where sick people are cared for, but that is a story by itself.[4]

Our Chicago manufacturers of plumbing supplies and fixtures are in the forefront of the race to design and produce equipment as safe to health as it is convenient, comfortable and beautiful. Our master and journeymen plumbers are alert to prevent dangers in plumbing construction. Our maintenance engineers are coming to understand the necessity and value of having all plumbing work done only by competent registered plumbers who are able to avoid health hazards. Our architects recognize the need for better design, which will assure ample pipe sizes to minimize the possibility of the production of a negative head in water pipes and to avoid overloading of sewer pipes. Many of our building owners know that safe plumbing from the standpoint of health protection is a good investment and a bulwark against future losses which might result if their plumbing systems, because of faulty design or construction, should lead to epidemics among their clients or tenants.

A renaissance of plumbing inspection in this country and abroad has followed the work of the Chicago Health Department growing out of this epidemic. Better maintenance of plumbing; safer design of fixtures; more adequate inspection of new plumbing installations and of alterations of existing ones; the establishment of a plumbing testing laboratory here and later in other cities; revision of a well-known, standard medical text dealing with amebic dysentery, taking account of the new ideas gained; a survey by the Government of plumbing in federal buildings; and, only this year, an exhibit of health hazards in plumbing at the New York World's Fair, which may become a permanent part of the American Museum of Hygiene—all these and more besides have followed in the wake of that celebrated epidemic.

The latest edition of "Public Health Administration in the United States" by Dr. Smillie, a recognized authority, stresses anew the importance of plumbing inspection as a function of the municipal health department, in its effort to safeguard all citizens.

The young men in engineering schools today have one distinct advantage over those of a generation ago,—namely, the fact that many consequences to health from engineering activities are recognized as important today which were either unknown or ignored then. Every future engineer should be given an opportunity to learn enough about health before and during his period of engineering training so that in his efforts to promote material prosperity, transportation, housing, utilities and development of natural resources, he will be able to avoid creating hazards to the health and lives of the people he seeks to benefit.

Honesty is fundamental to good engineering, and in fact to all scientific work. If an engineer should fake his figures, it would not be possible to conceal for long his dishonesty, as the fall of a bridge, the collapse of a building, the bursting of a dam, or some other evil result of his folly would reveal it. As the result of experience, the public has faith in the honesty of the engineer. Because of the confidence which people have learned to place in the scientific man in general and in the professional engineer in particular, his views on a wide range of subjects, many of them outside of his immediate field of activity, carry great weight in his community. Therefore, in the important field of health promotion, as well

as in other directions, the engineer should strive to become well informed, both to protect his own health and also to promote the welfare of the many others who have come to look upon him as a leader in matters requiring good judgment and sterling honesty.

References

(1) "The Significance of Water-borne Typhoid Fever Outbreaks, 1920-1930," by Abel Wolman, Dr. Eng., and Arthur E. Gorman, B. S., Journal of the American Water Works Association, Vol. 23, No. 2, February, 1931, page 160.

(2) "Water Borne Outbreak of Brucella Melitensis Infection," by A. W. Newitt, M. D., T. M. Koppa, M. D. and D. W. Gudakunst, M. D., American Journal of Public Health, Vol. 29, No. 7, July, 1939, P. 739.

(3) "Epidemic Amebic Dysentery—The Chicago Outbreak of 1933," National Institute of Health Bulletin, No. 166, the United States Public Health Service, Superintendent of Documents, Washington, D. C.

(4) "Health Hazards in Plumbing," by Herman N. Bundesen, M. D., The Modern Hospital, Vol. 44, No. 4, April, 1935.

"Safeguarding the Sterile Water Supply," by Joel I. Connolly, M. S., The Modern Hospital, July, 1935, P. Vol. 45, No. 1.

PROCESS CONTROL

(From page 18)

through a properly designed electrode cell, at a determined temperature, used the magnified electric current so produced to actuate a Micromax electric controller on the line of one of our component materials. It is suggested that if the reader wishes to assure himself that he yet retains the fundamental engineering learned at Armour an attempt be made to sketch up such a circuit.

It is predicted that engineers are going to be increasingly interested in automatic control methods applied in the specific engineering lines in which we are most concerned.

MOTION STUDY

(From page 20)

in slant. Good motion study work demands the cooperation of observer and of worker. They work out together the answers to the problem of how to do the task best. What is more, the operation makes sense. It is not natural to sabotage one's own task. Men do it only when driven by frustrations or motives not inherent in the work itself. It is therefore not surprising to find, where motion study has been handled by an experienced man with due regard for the rights and interests of the worker as well as of the management, that opposition to it has commonly dissolved. As a matter of fact, there have been interesting endorsements of the principle of motion study by some of the national organizations of labor.

The interest of the engineer in the possibilities of motion study may be various. To the employer of other men, or to the man in charge of operations, the technique offers a valuable means of improved efficiency of operation. To the younger engineer there are interesting job possibilities. There is, of course, always a danger of a general rush towards this new field, and there are some evidences of a tendency in that direction at the moment. It looks, however, as though for several years there would be, as the wave of employer interest in the subject travels further, a demand for men trained in motion study work. The bulk of this training and the final proving of the man must come in industry. The principles are simple, but they are worked out with people under the most intimate circumstances, and always in an atmosphere of some question as to the final results of the change to the worker. Advice on the handling of these questions can be given in classes, but there is no way of really learning to handle people except to handle them.

As we enter a period of intense preparation for possible attack, a period which seems bound to call for the utilization of our resources to the utmost, motion study offers other possibilities. In the first place, the economy which results from motion studies is usually almost entirely net. One rearranges the task, usually with incidental but seldom with expensive changes of fixtures, and eliminates waste motions. No better way to widen bottle-necks, or to get the most out of our limited available equipment, could be found. In the second place, with the problem of large-scale induction of men into new tasks, motion study offers a marvelously effective tool for teaching. When an observer has been trained to precise observation of the elements necessary to performance, he is in a position not only to analyze for himself the methods of the skilled worker, but quickly to convey to other men the essentials of skill. Limited use of the moving picture has already been made as a means of demonstrating to workers how to perform a task. Learners have performed a task in synchronism with the movies, with an instructor on hand to point out defects in procedure, and if necessary, to show the learner just how his performance differs from the standard performance. Tasks which under the old hit-or-miss method required months or years for mastery may in some cases be taught in days.

Motion study does not, of course, provide all the answers. It does not provide a substitute for technical judgment, and the tool maker who must work out his fixture as he develops it will continue to rely on a broad range of technical experience. But so far as an operation is repeated often enough to make it worth detailed study, it can be broken down by experienced men into elements which can be taught.

The idea of motion study is not confined to routine industrial operations. The German army has profited tremendously from the meticulous attention to detail which characterizes the motion study technique. Some of the most interesting studies have been made of clerical routine; sometimes dozens of meaningless shufflings of papers disappear when one so much as becomes aware they exist. The directions in which this method can be applied are many. The possibilities of the release of national energies are large. Fortunately, the procedures are so simple that they may be quickly learned, at least to the point of practical utility.

It may be asked: "Does not this detailed analysis remove all room for initiative, for creative skill in industry?" It may, if one regards it as a dictatorial procedure, but when the motion study man thinks of himself as a teacher, then the process offers to both teacher and learner possibilities of release of creative effort. It is axiomatic that a man enjoys and takes pride in a task which he does well. A surprising number of people in this world, often without full consciousness of the fact, feel themselves balked and limited by an imperfect mastery of their work. Surely there can be no more constructive task than to supply to such men the skill which transforms them into fully effective members of society. As to the charge of routinizing, Frank Gilbreth pointed out many years ago that one of the most routinized operations in the world is that of the skilled surgeon who, with the life of the patient often at stake, has to find the best method of performance and reduce it so definitely to routine and second nature that his mind is released for creative study and improvement of his task, and for the meeting of emergencies.

Many people are happiest in the security of work which is essentially routine. It is foolish to speak of the joy of creative work as an essential element in the happiness of the average individual. However, so far as motion study introduces a change into the humdrum of work-a-day life, the direction of this change seems to be all toward not only greater productivity but greater competence and self-assurance.

ARMOUR-LEWIS

(From page 22)

Instruction in Architecture continues at the Art Institute, under the administration of Armour College of Engineering.

Armour College of Engineering:

Enrollments in Armour College, in spite of increased care in selection of candidates for admission, reached the all-time high of 1360 students in the four year course, and about 400 in the Co-operative Course in Mechanical Engineering, making a total of 1760. Of these, 422 were new students, 375 were freshmen, and 47 were transfer students with advanced standing from accredited colleges. There is a substantial increase in enrollments in Architecture and Civil Engineering. In the three upper classes, but not counted as new students, are more than half of the engineering students formerly taking day courses at Lewis Institute. A liberal policy has been followed in integrating these men into the student body, and provision was made by the Board of Trustees whereby most of them received partial scholarships, looking to the adjustment of tuition changes, for the current academic year, to correspond approximately with former tuition rates at Lewis. There is every present indication that these men are adapting themselves splendidly to their new environment. It is expected that about twenty former Lewis engineers will be graduated in June, 1941 with the first graduating class of the Illinois Institute of Technology.

Members of the faculty of the former Lewis Institute now teaching engineering students in the day classes on the Armour College campus include Louis J. Haga in Metallurgy; Frank H. Wade and Everett C. Shuman in Mechanics; Paul G. Andres and LeRoy T. Anderson in Physics and Electrical Engineering; J. S. Kozacka in Mechanical Engineering; Gilbert Halverson in Physics; Millard P. Binyon in Language and Literature; Mrs. Marie W. Spencer in Economics; and John F. Wagner in Mathematics.

Lewis Institute of Arts and Sciences:

The enrollment at Lewis Institute of Arts and Sciences in the Day School is over 480, which represents a slight increase of the purely Arts and Science students over last year. In addition to this, there are 57 freshmen pursuing courses at Lewis in the curriculum of Armour College.

Members of the faculty of the former Armour Institute of Technology now teaching classes at Lewis Institute include B. B. Freud and Melvin L. Schultz in Chemistry; James S. Thompson in Physics; John W. Calkin in Mathematics; Walter Hendricks and Sanford B. Meech in English; John D. Larkin in Political Science; Grant N. Stenger in Physical Education and Gym work for men; O. Gordon Erickson in Music; and D. C. Lincoln and Alvin Turley in Chemistry as graduate assistants.

At a student assembly under the able leadership of John J. Schommer, opportunities were presented to the Lewis students to participate in various extra-curricular activities already organized and under way at the Armour College. As a result, a number of students are already making plans to take part in some of these activities. The mingling of the students of Armour and Lewis in such a manner cannot help being constructive and satisfying.

Evening Division:

The program of the Evening Division, integrated, and operating on the two campuses, has an indicated enrollment of about 3756—2248 on the South Side, and 1508 on the West Side. It was necessary to close registrations in a number of classes because of insufficient facilities to take care of all applicants.

Graduate Division:

After a successful Summer Graduate Institute, operated in three terms of four weeks each from mid-June to mid-September, and staffed by distinguished scholars from other campuses as well as our own, the Graduate Division shows increased enrollments in both day and evening classes. Out of a total of 361, 76 are in day classes, the balance being employed engineers and scientists, taking part-time programs in the evening. The great majority are candidates for higher degrees.

It is the conviction of all concerned that the process of integrating the two schools, both having been independent for nearly fifty years, having developed somewhat different patterns, and located on campuses separated by several miles of city streets, is proceeding with an orderly effectiveness beyond what ordinarily could be expected, a result arising from a pervading spirit of cooperation and of enthusiasm for the new program.

BOOK SHELF

(From page 28)

their felt tents, and tamed their herds of horses. It was these isolated and wandering dwellers of high Asia, with the hard skin, squinting eyes, and bowed legs of perpetual riders, and with their lives as well as their bodies shaped by the wind and the earth of the steppes, who swarmed ceaselessly against the walls both of occidental and oriental civilizations. For most of our history, it was the steppe-country that produced the invader; thence rode the Medes, the Aryans, the Scythians, the Huns, the Bulgars, the Avars, and the Magyars—indeed, nearly all the hostile peoples who shook the kaleidoscope perpetually into sudden and startling patterns; and if Rome fell before Teutonic and Gothic attackers, it was only because these in turn were pressed by the fiercer hordes from the north.

Mr. Lamb's narrative puts vividly—at times even magnificently—before us that amazing motion of barbarous peoples; the horseback Emperors, the people of the felt tents, the dwellers in all the Russias, the savage steppe-country itself, all become strangely familiar and real; Genghis-Khan, Ogadai Khan, Tsar Batu, Kubilai Khan, Tamerlane, and Peter the Builder seem to emerge from legendary darkness and become part of the actual world, an intelligible tissue of man's history. I recommend this book enthusiastically; even the most naive reader ought to find pleasure and profit in it.

The second book I should like to call to your attention is the new ENCYCLOPEDIA OF WORLD HISTORY (Houghton Mifflin, $5.50), edited by William L. Langer, with the collaboration of some fifteen distinguished historians. This volume, primarily a reference book, stands of course at the opposite extreme from the books of Harold Lamb; you have here history stripped to the bone, sans the arguments, and insofar as it is practically possible, the hypotheses, of historians. The work is advertised as a revision of Ploetz' famous *Epitome of Universal History*, and was originally undertaken as such; but in point of fact it owes little if anything in that direction. While one must grant the editor's claim that the narrowness and Teutonic bias of Ploetz have been avoided in this work, one may nevertheless regret the omission by the present editor of countless details which made the *Epitome* so ex-

ceedingly valuable; indeed, in most respects of thoroughness, clarity, and richness of historical information, the older volume is the superior. Nonetheless, the *Encyclopedia* is a very useful and respectable book; and I am sure that you will find it an indispensable companion to your daily newspaper.

Elder Olson.

In the past fifteen years, with an increase of only four percent in piston displacement, there has been an increase of ninety-one percent in brake horsepower of the automobile engine. Likewise in that same period the useful mileage life of the automobile has increased by 475 percent. The major portion of the useful mileage increase has occurred during the past six years.

If those engineers responsible for the advance in the automobile and aviation industry were asked to list the first three or four things that are largely responsible for the outstanding strides that have been made in these industries in the past few years I am sure all of them would include one thing that has been known for many years, but which has not been made use of on any broad scale until about six years ago. I refer to "superfinish" and the Director of Production Research of the Chrysler Division of the Chrysler Corporation, Mr. Arthur M. Swigert, Jr., in his new book, The Story of Superfinish, gives a technical description in perfectly understandable language of this development that started with civilization and culminated in one of the most important factors in a great many of our modern industries, particularly that of the automobile and aeroplane.

Mr. Swigert develops his subject in a style that will make this book of great interest to the student of engineering. He incorporates sufficient detail to make the book of value to men engaged in production or in charge of production methods. A very clear picture is given of the five primary methods of finishing metal surfaces: turning, grinding, honing, lapping, and superfinish, not only from the standpoint of producing them but in connection with their relative usefulness in the modern machine.

Because of the importance of finish in problems of lubrication, Mr. Swigert incorporates a most enlightening chapter on lubrication and its relation to surface finish.

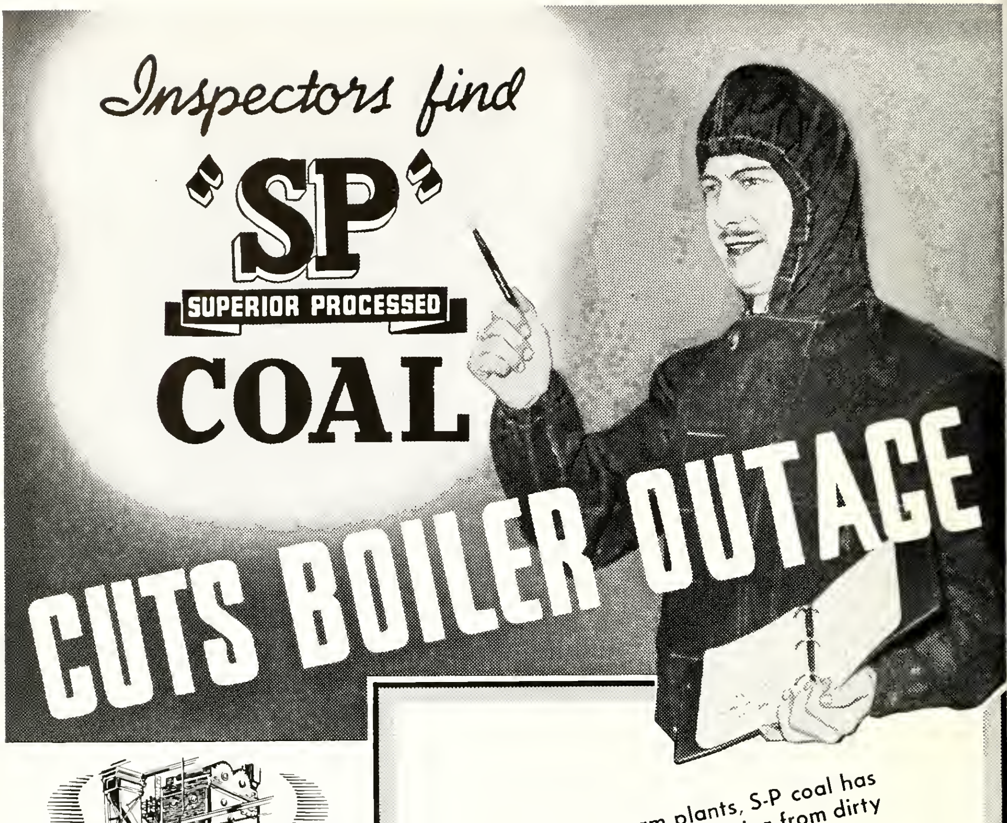
Metallurgy comes in for considerable discussion in connection with the part it plays in making possible the production of superfinish as well as in its usefulness.

Mr. Swigert's book is a timely presentation of one of the most important aids that man has found in approaching the solution of the problem that he has set for himself, namely the development of the perfect machine.

This compilation of techniques employed in the development and production control of Superfinish will be of great value to the industrial research man in the solution of many problems outside of the field of superfinish.

Thos. C. Poulter.

ENGINEERING TRAINING IN WARTIME AND PEACETIME IS ESSENTIAL TO THE NATION'S WELFARE



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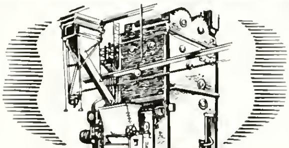

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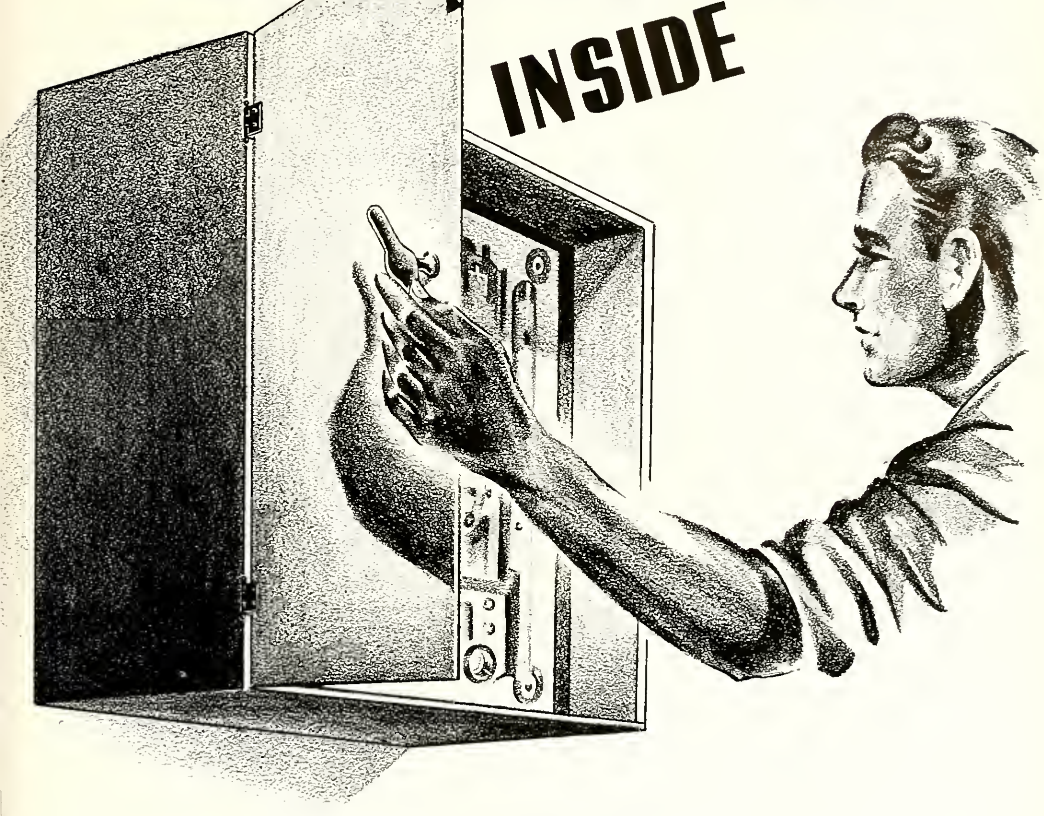

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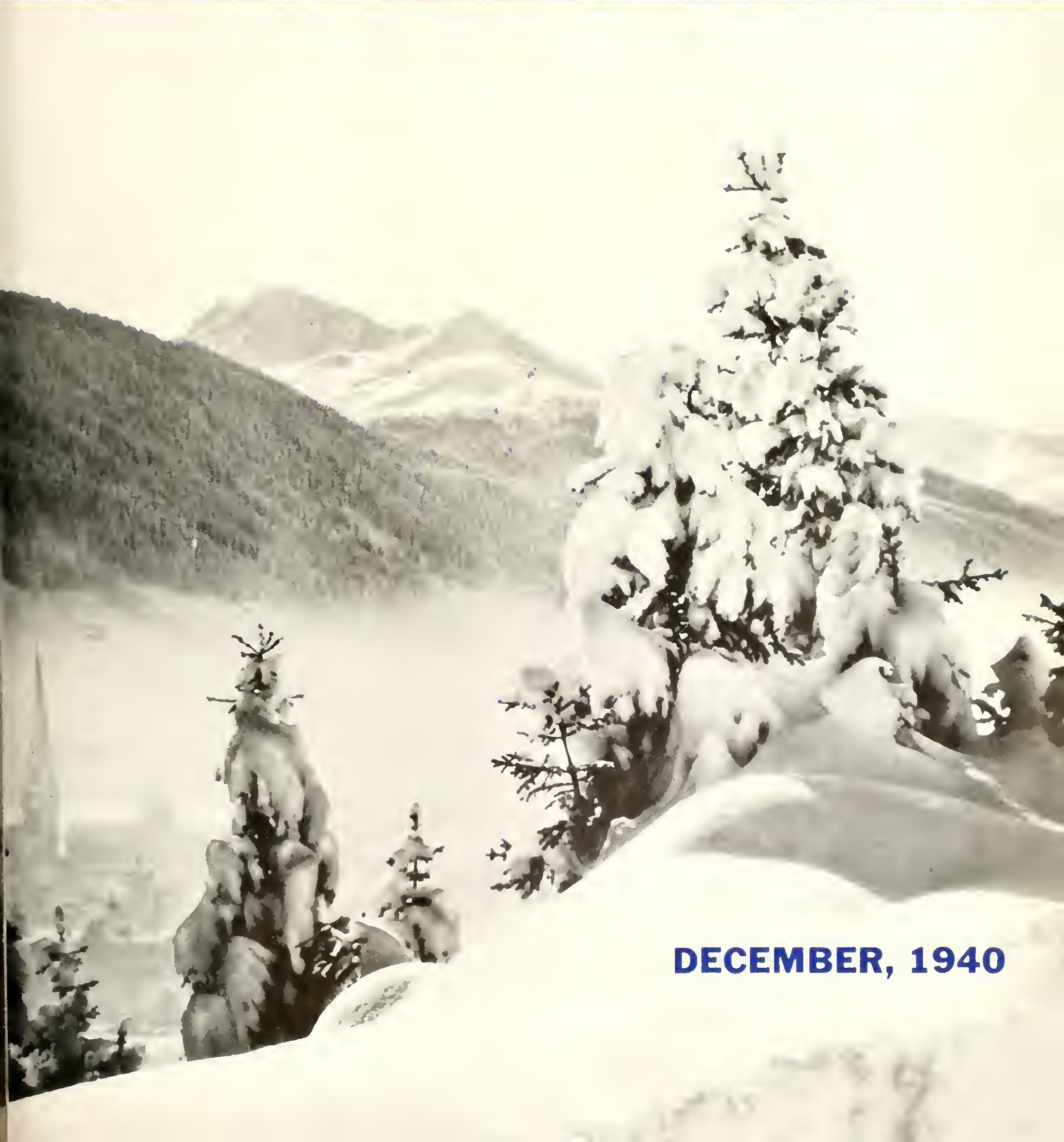


DECEMBER, 1940

G-E Campus News

MICROANALYSIS

IN ordinary chemical analysis, where material is plentiful, the work is done on a scale most suitable for obtaining the results sought. Samples are relatively abundant; they may be used prodigally.

Not always, however, is the material for test so plentiful. The General Electric Research Laboratory at Schenectady, N. Y., handles the exceptions with its facilities for "microchemistry," in which the amount of test material available controls both the scale of operations and the strategy of attack. Microanalyst Charles Van Brunt, Harvard, '32, of the laboratory staff is prepared to test material whose limit in smallness is set only by the refinements of manipulation attainable under the microscope with the aid of a "micromanipulator."

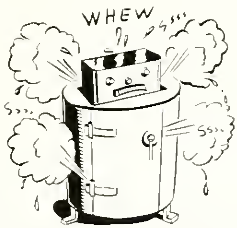
Seldom does Van Brunt attempt to identify or classify materials in solution volumes less than a cubic millimeter (about the size of a pinhead). But to analyze an ordinary drop, as delivered from a medicine dropper, is comparatively coarse work for him—near the upper limit of the true microchemical range.

FROZEN LIGHT

THE "late" Baron Munchausen was accredited (by himself) with incredible feats among which was freezing the ring of a bell. Recently, however, General Electric Research Laboratory scientists at Schenectady, N. Y., outdid the Baron by freezing light.

In producing this frozen light, G-E scientists submerged fluorescent plates in a large thermos bottle of liquid air with a temperature of 320 degrees below zero. The bottle and the plates were then bombarded by x-rays, exciting the atoms of fluorescent material on the plates literally freezing them stiff. When the plates were removed and allowed to warm up, they glowed with all the colors of the rainbow.

A "bottle" of frozen light was sent to East Orange, N. J., where it was unveiled in connection with the ceremonies marking the premiere of the motion picture, "Edison, The Man."



RADIO TURKISH BATH

RATS and moisture seem to be the two chief enemies of radio sets in the tropics. A letter from the Belgian Congo testifies to the rats; the evidence for the humidity is already ample. Except for recommending traps, there is little the General Electric Company can do about the rats, but the study of humidity is right up its alley since G-E engineers at Bridgeport, Conn., have built a humidity chamber capable of reproducing the weather conditions of the tropics.

Lamps under water tanks provide humidity by vaporization, and generate enough heat to maintain a temperature of about 100 F. Humidity and temperature are controlled by time clocks outside the sealed chamber, while uniform weather conditions are maintained within the chamber by circulating fans.

Radio receivers placed in this room are continuously subjected to conditions far more severe than those of the tropics until failures occur in the sets. In this way, young engineering college graduates enrolled in the G-E Test Course gather data which contribute to the improvement of radio, not only in the tropics, but everywhere that radios are used.

GENERAL ELECTRIC

CONTRIBUTORS

JOHN DE CICCO is Instructor in Mathematics at Illinois Institute.

BARNETT F. DODGE author of numerous scientific papers and books, received in 1917 the S.B. from Massachusetts Institute of Technology; the Sc. D. from Harvard in 1925. From 1917 to 1922 he served industry as a chemical engineer, first with E. I. du Pont de Nemours & Co., and later with the Lewis Recovery Corporation. Lecturer in chemical engineering at Harvard during 1921-25 he joined this department at Yale in 1925. Since 1931, he has been chairman of the department. In addition to his duties at Harvard and Yale, Professor Dodge lectured during 1922-25 at Worcester Polytechnic Institute, and in 1925 served as chemical engineer at the fixed nitrogen research laboratory of the U. S. Department of Agriculture. During 1940, he was visiting professor of Chemical Engineering Thermodynamics at the Summer Graduate Institute of Illinois Institute of Technology.

LUDWIG HILBERSEIMER was born in Karlsruhe, Germany, and studied at the institute of technology of that city. Having later established himself in Berlin as an architect, Professor Hilberseimer wrote extensively on the subject of modern architecture. In 1928 he was appointed Professor of City Planning at the Bauhaus in Dessau, where he founded the department. Since 1938 he has held the position of Professor of City Planning at the School of Architecture of Illinois Institute of Technology. The works of Professor Hilberseimer include **Internationale Neue Baukunst, Grosstadt Architekur, Beton als Gestalter,** and **Hallenbauten,** the last a treatise written for **Das Handbuch der Architekur.** In a work recently completed, he has further extended his ideas regarding city planning.

ELDER OLSON is Assistant Professor of English at Illinois Institute.

CLARENCE OLDS SAPPINGTON received the degree of Doctor of Medicine from the Stanford School of Medicine in 1918. The year following he became chief surgeon of the Pacific Coast Shipbuilding Company, and in 1920 was commissioned assistant surgeon in the United States Public Health Service at San Francisco. Following two years of study, he received from Harvard in 1924 the degree of Doctor of Public Health. In 1928 Dr. Sappington came to Chicago as Director of the Division of Industrial Health of the National Safety Council, which supplies an advisory service to American industry on problems of health and safety. Two years later he was chosen as a delegate to the International Hygiene Congress at Dresden. In 1932 Dr. Sappington opened his present office in Chicago as a consulting industrial hygienist, and since that time has served in fifteen states as consultant to many large, medium, and small companies. In addition, he has been consultant to a number of insurance companies, and is Editor-in-Chief of **Industrial Medicine.** His voluminous contributions to the literature of industrial medicine and hygiene number more than two hundred reports, articles, monographs, and books. Of the last, the **Medicolegal Phases of Occupational Diseases,** was given the **William S. Knudsen Award** by the American Association of Industrial Physicians and Surgeons, for having made "the most outstanding contribution to industrial medicine 1938-1939."

ARTHUR WILLIAM SEAR joined the faculty of Illinois Institute of Technology in 1925. His interest in radio began with a course in radio communication from Professor G. M. Wilcox, outstanding pioneer in this field. At the conclusion of the course, Professor Wilcox requested Mr. Sear to assist him in his research and consulting work. Upon Professor Wilcox's retirement in 1933, the radio engineering work was transferred to the Electrical Engineering Department, and Mr. Sear placed in charge. Since that time the energy of Professor Sear and his close association with radio engineers have kept instruction and laboratory work at Illinois Institute fully abreast of all developments in the field of radio communication.

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IN THIS ISSUE

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The City in the Landscape

THE ELEMENTS OF CITY PLANNING

By

LUDWIG K. HILBERSEIMER

Three main factors have contributed to the rapid growth of cities in the last century and have brought about the present congestion of population: freedom to migrate, the development of industry, and the increased facilities of communication. But no regulating principle, no principle of order adequate to control these activities could be formed. The consequence has been that forces originally constructive soon became destructive forces.

Most of our cities are an outgrowth of a centralized system which developed organically out of the conditions natural to a city of pedestrians. The cultural, administrative and business center was always located at the heart of such towns within easy reach from the outskirts. Means of communication for handling crowds were unnecessary. This held true whether these towns were of the so-called organic type such as Noerdlingen, or whether they were geometric in their layout like Priene: there was always a characteristic movement toward the center.

As these towns grew, sometimes to cities of vast size, they continued to develop along this same system of centralization. While this was thoroughly satisfactory for small towns, it has proved equally as inadequate for the large cities of our age. The congestion of population brought about problems that such cities were unable to meet. The increased demand for housing was met by a spawning of unwholesome tenements with insufficient light and air. Large factories, built with no regard for the nearby residential districts, soon infected these with their smoke and fumes. This seriously exaggerated the already inadequate sanitary conditions.

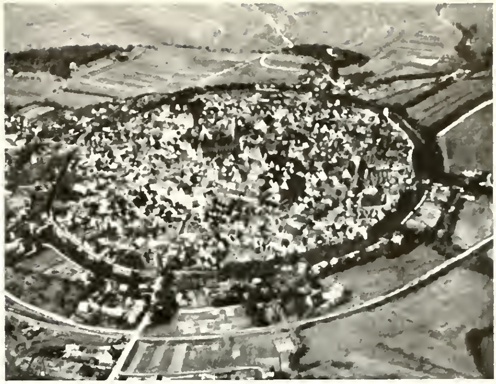
The steadily increasing city traffic required for the transportation of the population soon made obvious the inefficiency of the existing city arrangement. All means of transportation led to a single point, the city center. The confluence of all the communication lanes at the heart of the city resulted in a disastrous blocking of traffic there, while at the same time the outskirts of the city suffered from a shortage of public conveyances. This condition is evident from a traffic diagram of London. There we can readily see how such a system of centralization is at odds with modern mechanical means of communication.

The final blow to centralized city planning came from the automobile. This factor, which seemed so unimportant in its early days, has brought about a complete revolution. Means of conveyance dependent on rails because of their cost, had always been limited to a few lines. In contrast with this, the automobile is restricted to no definite road. In addition, its speed has further complicated the problem with the number of traffic accidents we see increasing from day to day in our cities.

I

Concurrently with the centralized city a new plan of urban organiza-

Noerdlingen—Typical Organic City



Priene—Typical Geometric City

ion has been evolving during the ast few decades. This plan, much etter adapted to our present-day lemands, is the system of ribbon de-elopment. As the origins of the entralized system can be traced to n old form of settlement—the cir-ular village which grew out of a eed for defense—so the "ribbon levelopment" also has had a fore-unner in the simple village built long both sides of a street.

In its present form the develop-nent of this ribbon system of town lanning can be traced to the Span-sh writer, Soria y Mata (*La Ciudad Lineal*, Madrid, 1931). In 1882, he uggested the idea that the city hould be built along a main artery f communication. This, he claimed, vould be the city of the future, the nds of which might be Cadiz and t. Petersburg, or Peking and Brus-els. "If you lay railroad and street ar lines, gas, water and electric nains along one principal channel, nd place at fixed intervals some mall buildings intended for various ocal administration offices, all the problems created by the concentra-tion of population in the central type city will be immediately solved. The expansion of such a city would be very simple. At any point along the line where it is necessary or topo-graphically possible, a new town could be started at an angle to the main line like the branch of a tree." The scheme of Soria y Mata was originally intended to connect two densely populated cities. On both sides of this main channel residen-tial zones were to be located in the adjoining country. "The character of infinity, typical of the ribbon town which can be elongated on two sides while it is limited on the other two sides, makes it an ideal form for civilization and culture."

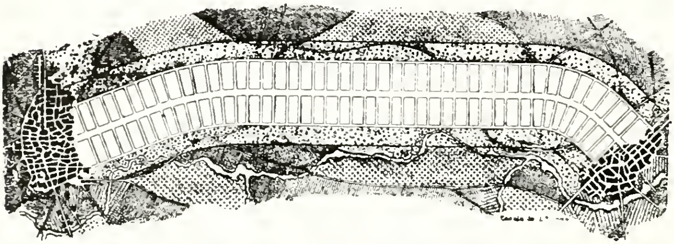
To compare the central type city with the ribbon type on the basis of suitability and economic expediency, it would be necessary to take two ideal areas of equal size and sim-ilar communication problems. One such ideal area was taken by Lud-wig Sierks and worked out on the basis of the centric system. Peter Friedrich took Sierks' proposal as a basis for a comparative solution by ribbon development. He adopted an ideal area of the same size and character as Sierks had proposed. In the centric plan of Sierks there were thirty-six terminals from which two trains left every hour, that is, sev-enty-two trains for the whole system.

In the ribbon plan of Friedrich there were only twelve terminals. From each of these, six trains were able to leave every hour. The total number of trains was therefore the same, seventy-two trains for each system. However, in the centric system, trains left only every half hour, whereas in the ribbon system they left every ten minutes. The av-erage distances between center and terminal in the first system was 3.5 miles. In the second system the dis-tances were, however, 4 miles. The running time therefore had to in-crease accordingly. But this was made up for in the ribbon system by the shorter waiting time, due to the fact that in this system three times as many trains were running

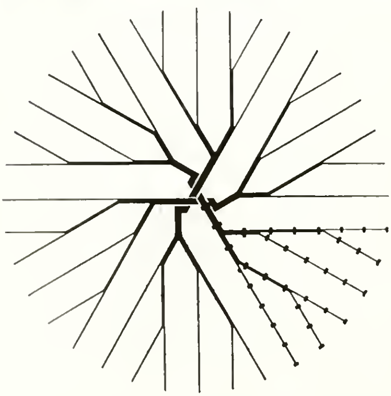
Circular Village

Street Village

London—Traffic Diagram

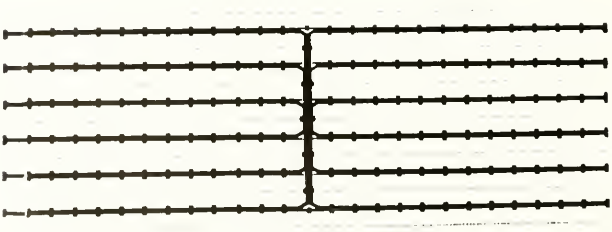


Soria y Mata: LA CIUDAD LINEAL—1882



Left: Ludwig Sierks Centralized Traffic System

Below: Peter Friedrich Traffic System in Ribbon Development



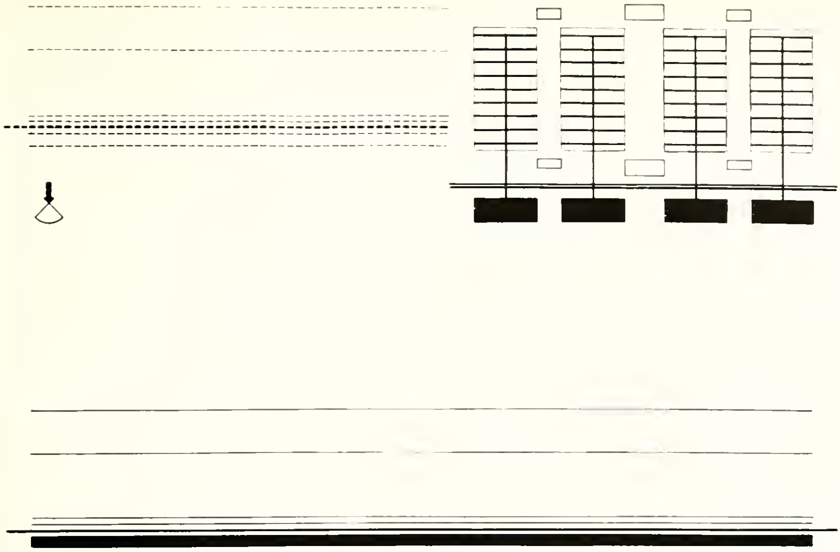
as were running in the centric sys tem. In the latter system the num ber of trains would naturally in crease toward the center, due to th overlapping of the various zones c influence as the center is reache In the ribbon system, on the con trary, the number of trains remai in all parts the same except on th center line where all trains mee The accessibility to means of com munication is practically equ throughout the whole area. The su periority of the ribbon developmen as far as transportation is concerne is evident.

The question arises whether trans portation should be regarded as th main problem of city planning, c whether it might not be possible t eliminate mechanized local transpo tation altogether through the estal lishment of a rational relationshi between the various elements const tuting an urban settlement. Just a medicine in its recognition of th dangers of specialization tells u that there is no disease, only th diseased, there are also special prol lems in city planning. In city plan ning it is also of the greatest in portance that special problems n be solved individually, but only i relation to the whole. Only then ca the city recover.

II

Residential sections, industrial dis tricts, recreation areas, and means c transportation are the basic ele ments on which a structural tow must be organized. The function adaptation of these various element and their suitable relationship co stitute the real task of city plan ning. In order to protect the res dential section from the smoke, soo and fumes of the industrial zone, th relationship of these two areas t one another must be determined b the prevailing winds. These wind distribute the fumes and soot in th lee of the industrial zone, thus d termining what may be called "wind shadow." The residential zon must be entirely outside this "win shadow." As the type and distribu tion of the prevailing winds chang different forms and locations of th residential and industrial zones wit relation to one another will resul However, they must always be s placed that the industrial zone li in the wind shadow, while the res dential zone is undisturbed by it.

The four diagrams show the influ ence of typical, prevailing wind fo mations on the grouping of basic cit units and illustrate what great in portance wind conditions hold fo city planning. Referring to the di grams we see that:



The Ribbon System and Its Development
Upper Right Corner: Scheme of Dividing

When the prevailing winds blow from one direction only, there results a simple ribbon form of settlement in which the industrial zone lies in the wind shadow, in the lee of the residential zone. The distance to the next settlement ribbon will depend upon the area necessary for the absorption of the industrial smoke and fumes which in turn will vary with the type of industry and the kind of fuel used.

When the winds blow in two directly opposite directions which have wind shadows of equal area and shape, the result is also a ribbon settlement form. However, the two most important elements —residential and industrial areas —are no longer themselves ribbon-like, but rather become squares placed point to point with their diagonals forming an unbroken straight line. As in case one, the next settlement ribbon can run parallel at an adequate distance.

When the prevailing winds blow from two different directions, and one wind shadow dominates the other, the result is also a ribbon settlement form; only here the squares placed point to point in case two become triangles lying with their apexes opposite one another as the form for the industrial and residential areas. Here again, as in the preceding cases, the adjacent settlement ribbon can run parallel.

4. In the cases cited above the prevailing winds were so distributed on the wind chart that the total wind shadow never exceeded half of the area of the circle. However, should this be exceeded, the residential and industrial areas would form squares lying opposite one another, but now parallel and directly opposite ribbon-like settlements become impossible. A wind shadow of such proportions permits only a point formed arrangement of the single settlements which must be built independently of one another. The spacing of these single settlement points is, as in the other cases, dependent upon the size of the absorption area. Only in this case the area is not, as in the first three, one or two sided, but to a certain extent all sided. The arrangement of several such settlements in this case results in a ribbon formation, but one where this formation is not continuous as in the other examples.

To simplify the problem of the proper relation between industrial and residential areas, the simplest form, case one, where the prevailing winds blow from but one side, will be taken as the basis of further discussion, though any other case can just as well be taken, since, in principle, the same conditions hold true.

Where the ribbon system is taken as a basis, a structure which clearly separates the different areas of a settlement is obtained. If these different elements are laid out schematically it is logical that the strip dedicated to transportation should be situated in the middle. On the leeward side would be situated the industrial zone, bordered on the outside by an agricultural area. On the other side of the transportation strip there first would come a green belt, followed by the administration and business zone; beyond this the residential zone. Then this, in its turn, would be followed by a park area in which are located the community buildings and kitchen gardens. The park area leads to the agricultural area just beyond. This agricultural area could connect with the agricultural area of the next parallel ribbon settlement.

The central transportation lane or strip would be the axis of the settlement. It would be constituted of railway tracks and the main automobile speedway, and perhaps of a waterway. The type of transportation facilities varies with the type of industries and according to the size and location of the settlement, and

will differ greatly according to the characteristics peculiar to each settlement. Conditions of production will differ according to the nature and size of the industries, and will therefore develop in connection with their peculiar requirements, perhaps modified to some extent by military and defense factors.

The residential area is above all dependent for its size upon the number of employees needed by the industries. The basic demand, which limits the boundaries of the residential zone, is dependent on the acceptable walking distance of the pedestrians, so that each person can walk from his home to his place of work. Therefore inner means of transportation for persons to and from work would be unnecessary. Only in residential zones of a comparatively thin population will it be expedient to connect kitchen gardens with the houses. Normally, kitchen gardens will be located in a separate open zone, while only a small garden will be directly connected with the house. In this way the length of streets and conduits for water, gas, etc. will be kept to a minimum, and the cost of settling an area can be reduced considerably.

The administration and business zone will contain all the state and municipal buildings, all office buildings, department stores, retail stores, hotels and garages. The park and recreation area unites all free areas. In it are located community buildings, schools and playgrounds. The residential zone will be situated within these open areas and become a part of them. Also, the kitchen gardens will be situated within these open areas. The resulting productive green space not only increases the recreation area, but also considerably reduces the cost of its maintenance.

The width of the agricultural area will depend upon two things; first, the open space necessary for the absorption of the smoke and fumes of the adjoining industrial ribbon. This of course will vary from one instance to another. Secondly, it will depend upon the population of the settlement which it has to supply. Normally the area located between two settlements would be sufficient to feed the whole population. In the case of densely settled industrial areas additional agricultural areas not in immediate connection with the settlement will be necessary. The same will be true at points of central and regional concentration other than in the industrial area. Points of concentration due to local conditions will have to receive their food

Wind Diagrams 1 and 2

supply from other agriculture areas. The type of industry and its possibilities of expansion will determine the extent to which expansion of the residential zone will be necessary. These expansions, however, should develop in the direction of the transportation strip. In this way, a logical expansion can be concurrently made throughout all the adjacent areas of a settlement. An expansion in depth rather than along the transportation strip would naturally require additional means of transportation within the units which would conflict not only with the economic basis but also with the safety of th[e] residential area.

The residential zone will be di[-]vided into specific units. In th[e] scheme presented here, the area ha[s] been divided into four units. Eac[h] unit has those community institu[-]tions which are necessary for a singl[e] unit. Two units together have thos[e] institutions which are possible onl[y] for two units, while all four unit[s] together will have those communit[y] institutions and services that can bes[t] be maintained by all four as a grou[p]. The institutions of the business an[d] administrative zones can be dis[-]

Wind Diagrams 3 and 4

tributed in the same way. The rigidity of the scheme will be broken not only by the division of the settlement in units, but also by the particular condition of the soil, forestry, and the like. This makes the settlement part of the landscape and creates an organic relation between the landscape and the city.

III

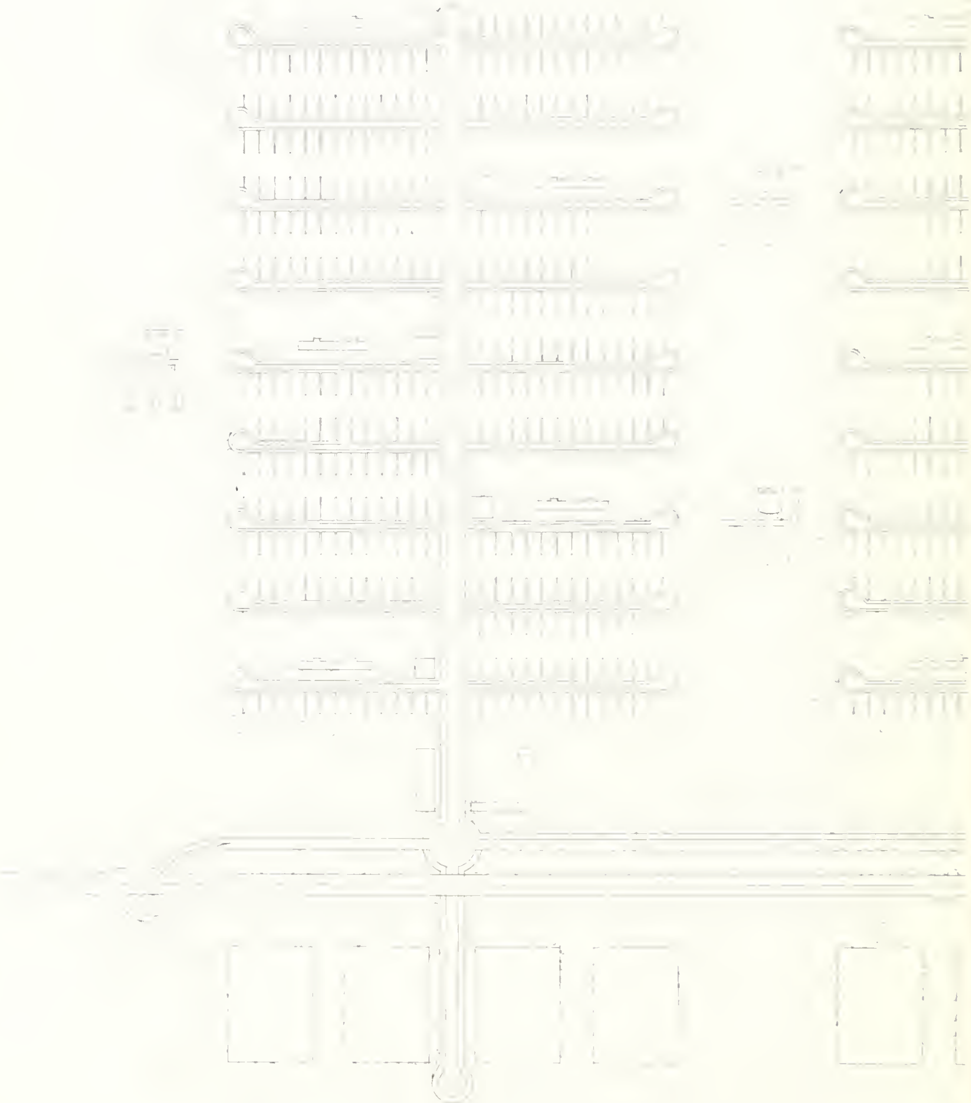
The determination of the size of a unit within the residential area will depend mainly on the total inhabitants, the density of population, and the type of buildings. The most important consideration, however, is the depth of these units. It should be possible for every resident to walk to and from his place of work. The depth of the residential area therefore should not exceed more than a walking period of 15 to 20 minutes. The necessary limitation of traffic within the residential zone and the functional organization of the street system leads to differentiation of traffic routes: from the residential streets intended *only* for pedestrians, to main speedways *only* for automobiles.

We will have, for example, first residential lanes; secondly, residential streets into which the residential lanes lead; thirdly, residential traffic streets into which the residential streets lead; and finally, the traffic highway fed by the residential traffic streets which eventually, at convenient junctures, flow into the main speedway. In order to prevent through-traffic in the residential zone, it is necessary to create dead-ends streets as it was first suggested by Raymond Unwin, and later by Henry Wright. In this way we can insure that only absolutely essential traffic, such as delivery cars, ambulances and fire engines, will enter residential zones. The length of the residential lanes depends upon the equipment of the fire brigades. Experience has shown that such equipment can be extended from 175-200 feet. Each unit of habitation is surrounded by park areas in which will be located all schools and playgrounds. These areas can be reached without crossing a single traffic street. Even if collective garages are not provided and each house has its own garage, the traffic system could be so planned that each child could go to school and to the playgrounds without crossing a single traffic street.

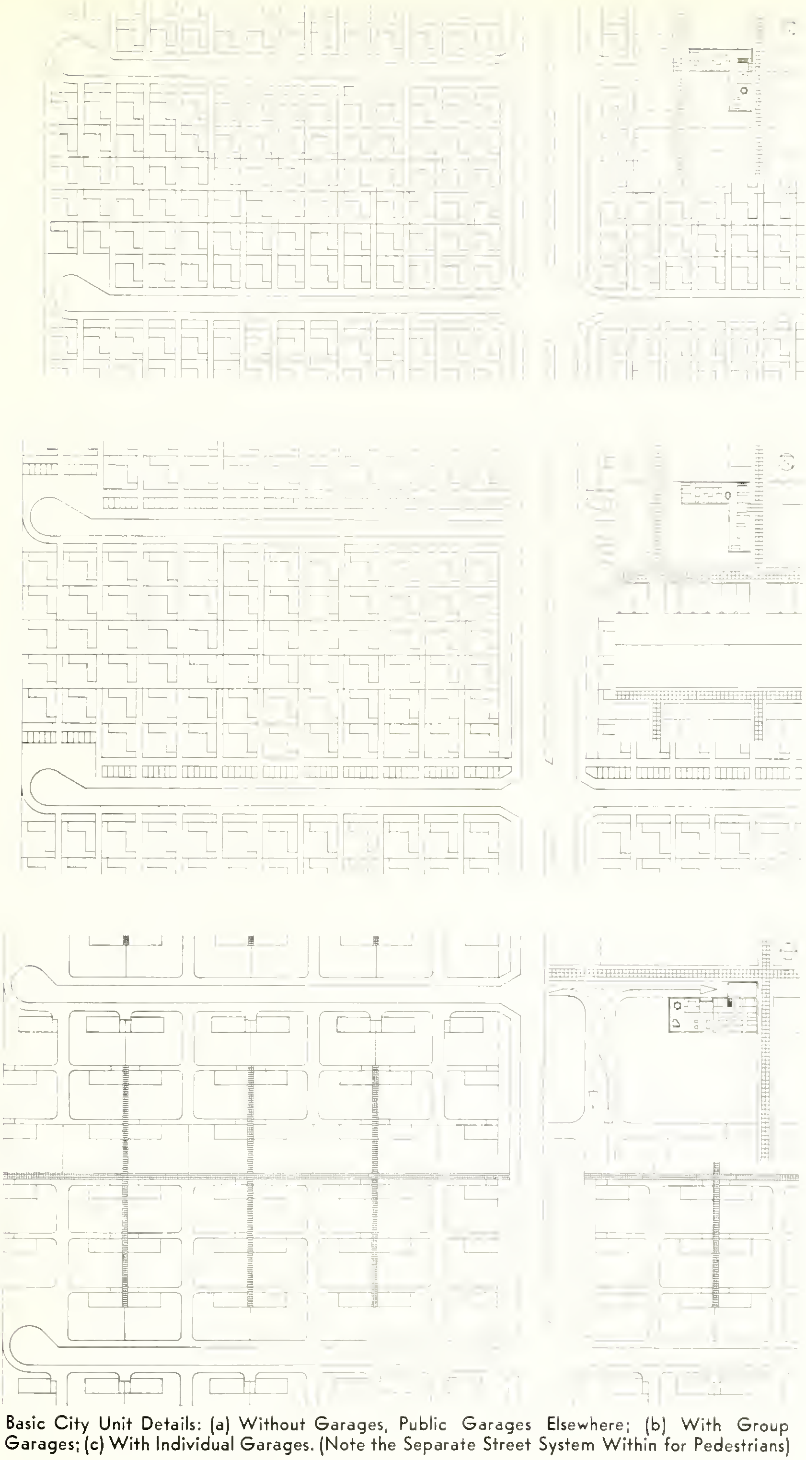
IV

Our plan is based on a population density of 200 persons to one hectare or two and one-half acres. Such a density allows a settlement with free-standing one-story houses. If an L shaped plan is used, the living-room and bed-rooms can be laid out around a small but well isolated garden court. The rooms can be given the best possible exposures; the living room gets morning and afternoon sun, the bedrooms morning sun. These one-family houses are planned for families with children. As the constitution of the population will vary, a different type of habitation would be better suited than the one-family house for families without children, or for unmarried persons—that is to say, the apartment house. Unlike the one-story one-family houses for family homes, these should be built high and at great intervals from each other.

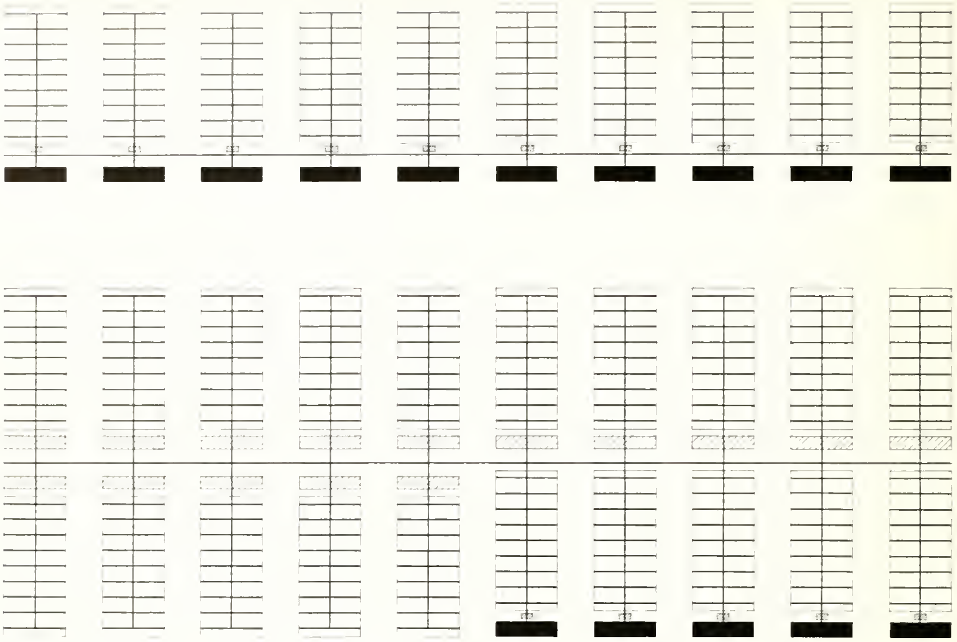
Such a mixed type of settlement can achieve freedom and privacy in two ways. The one family houses will have their enclosed gardens, while the apartment houses will have open views over the garden areas in which they are located. Such a variety of habitation allows also for a variety of expression, and the different units can be spatially diversified and shaped with complete freedom.



Basic City Unit



Basic City Unit Details: (a) Without Garages, Public Garages Elsewhere; (b) With Group Garages; (c) With Individual Garages. (Note the Separate Street System Within for Pedestrians)



(a) Element of Settlement for a Population of 125,000 Persons
(b) Element of Settlement for a Population of 250,000 Persons
Left half: City Formation Only for Commerce and Administration
Right half: City Formation for Commerce, Administration and Industry

Through its gardens and the limitations dictated by pedestrian traffic, such a settlement fuses with the landscape, and, in fact, becomes a part of it. The city is not only in the landscape, but the landscape comes into the city. The wider intervals between the few multi-storied buildings produce a visual sense of space within the city without any necessary reduction of the density of the population.

V

Can this system for the planning of small cities be applied to greater settlements, let us say of several hundred thousand inhabitants, or even of some millions of inhabitants? Can such a huge center of metropolitan concentration be broken up, provided with small gardens and thus be connected with the landscape? Above all, can the distance between living quarters and working centers be kept within the limits set by pedestrian traffic? Then, granted the possibility of such a decentralizing scheme, will the city still hold together organically?

Up to now the possibility of such a solution has been denied. But a thorough research of this important problem has shown that the decentralization of even the largest metropolitan agglomerations can be effected, while simultaneously retaining all the advantages which they offer. Also, the city can at the same time maintain an organic unity. But to effect this we must get away from the traditional conception of a city, and particularly from several of its peculiar limitations. The coming city will be based on entirely different assumptions. Decentralization will take the place of our present concentration. The city, as a vast ocean of houses, will disappear, and residential zones will be embedded into the landscape and become a part of it.

Already the general scheme of the ribbon development, which allows for additional city ribbons, separated by agricultural areas, shows that this plan may be adapted for larger settlements. According to this scheme two of the settlement elements can be developed simultaneously. In order to arrive at some simple figures, let us assume a population of 125,000 inhabitants for one, and 250,000 for the other of these elements, both with a density of 200 persons to two and one-half acres. We shall take the element of 125,000 inhabitants as a normal one. It includes besides the residential zone a business and administration zone, an industrial zone, and a transportation strip.

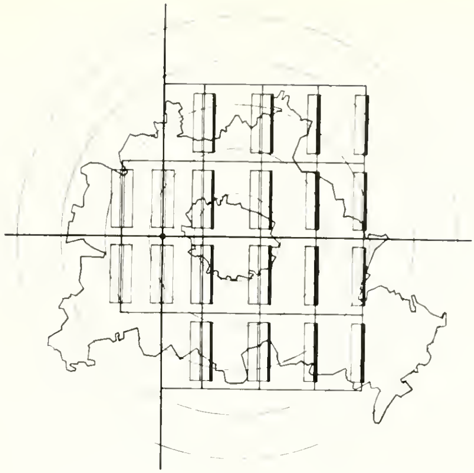
The other element of 250,000 inhabitants is intended for city formations in which trade and administration are of predominant importance. This element is further divided in two parts, each showing different possibilities. The part to the left of our divided element shows an arrangement of a city without industry. Therefore it is possible to have residential zones on both sides of the traffic strip, joined by the zones of commerce and administration. The part to the right shows an arrangement of a city, also with residential zones on both sides of the traffic strip. But on one side the residential zone is joined by a zone for commerce and administration, and on the other side the residential zone is joined by an industrial zone. This industrial zone is situated on the side of the wind shadow.

The depths of the residential zones of both settlement elements do not exceed the limits of pedestrian traffic, and means of local transportation would therefore not be necessary. Each resident of any large

city may walk from his home to his place of work. Both of these settlement elements are divided into units, each surrounded by gardens, parks and recreation areas that will connect them with the landscape.

Just as these elements will vary considerably according to their different functions, so the cities, composed of these elements, will likewise vary greatly. Size, area, the particular function—industrial, commercial, administrative—the composition of the population, geologic and topographic factors will determine the manifold possibilities of the combination. In order to give a concrete idea of the area needed for such a dispersed settlement with a population of four million inhabitants, a combination of elements has been spread over the area of a typical contemporary metropolis with the same population and an area of 200,000 acres. One-seventh of this city area is covered with buildings and streets at an average population density of 300 persons per two and one-half acres.

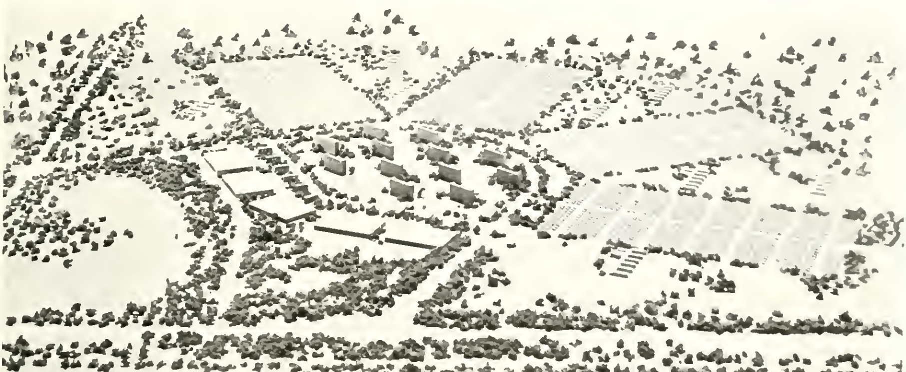
As our plan is based on population density of 200 persons per two and one-half acres, the area covered with buildings to house all inhabitants must increase to one-fifth of the whole area. In our plan the one family house forms the basis of our approach. The city, composed of our units, which are surrounded by parks, becomes a garden city. Therefore, the high blocks typical of most of our large cities will disappear. The distance between elements with industrial areas, as we have said, is dictated by the distance necessary for the absorption of smoke and noxious fumes. All other space is left free to the judgment of the planner. However, such space should be given to gardens and green areas for the separation of the various elements from each other.



Combination of Elements for a City of 4,000,000 People

It will be possible to cover the distance from living quarters to working center by foot. The various elements will be connected by interurban rail and automobile routes which constitute the links between the elements and thus connect the whole city. For long distance traffic, railroads and main speedways will be provided. Expansion of the city in any direction will be possible by the addition of new elements. If any person does not desire to live near his place of work, he will have the possibility of living somewhere else. In this case he would have to use certain means of transportation, as he must today, but under much better conditions.

It should not be necessary to explain that the suggested combinations of elements constitute neither definite city plans nor suggestions toward standardization; rather they are abstractions, for absolute cities do not exist. Cities are individuals. Their physiognomy depends on the character of the landscape, on their inhabitants and on their functions within the nation's life. Therefore, these elements which we have described and their manifold possibilities of combination are only theoretical. In order to find rules, it is necessary to set out on an abstract basis. In actual planning, these rules will, however, always be modified by the factors of reality, since city planning is not an abstract task but the fulfillment of needs and the realization of aims.



Reconstruction of An Industrial City

SOURCES OF ENERGY—PAST, PRESENT AND FUTURE

By

BARNETT F. DODGE

ENERGY AND MODERN CIVILIZATION

Our civilization differs from all those in the past in its dependence upon a large supply of energy from inanimate sources. In place of the privileged few in ancient civilization who had human slaves to do their bidding, each one of us today has at his disposal the equivalent of many slaves in the form of electrical or mechanical energy. Whether we use this gift wisely or not is a question entirely outside the scope of the present discussion. We shall assume that the survival of our present mode of life is absolutely dependent on a continued flow of energy in substantially undiminished amount.

This dependence on energy started about 1700 with the development of the steam engine for mine pumping in England, and has risen at an ever increasing pace. At the present time it is estimated that in the United States alone the annual use of energy is of the order of 2×10^{16} British thermal units or about ten thousand billion kilowatt hours. This includes not only energy in the form of mechanical or electrical work, but also that used for heating and that dissipated as heat in converting one form of energy to another. Only about four to five percent of this total is used to do work. In 1936, the installed capacity for developing power in this country was about 1,230,000,000 horse power distributed approximately as follows:

Motor vehicles of all kinds	78.5%
Locomotives	7.1
Agricultural prime movers	5.9
Electric central stations	3.7
Marine	2.4
Industrial power plants	1.6
Miscellaneous	0.8

The actual energy output in the form of work was about one hundred eighty billion kilowatt hours of which one-half was supplied by the major electric utilities and the other half came from motor vehicles.

To develop all this power we depend almost entirely upon fuels and falling water. In 1930, it is estimated that forty-three million tons of coal, and another eight million equivalent in the form of petroleum products and natural gas, were consumed by our electric central stations. In 1936, about twenty billion gallons of gasoline were consumed by the motor vehicles of this country. How long can we continue to draw on our known sources of supply at this rate, and what other sources of energy might be developed if these begin to fail? These are the two main questions that are to be discussed in this paper. But before we tackle them, let us refresh our memories on some of the elementary facts about energy.

FUNDAMENTALS OF ENERGY

We do not find energy stored in a form that is immediately available for use, and as a result it must be transformed. A typical transformation chain would be somewhat as follows: chemical energy in fuel . . . heat energy in flue gas . . . heat energy in steam . . . mechanical energy of rotating turbine wheel . . . electrical energy . . . useful application . . . heat in the surroundings. If we trace back the beginning of this chain to find out how the chemical energy got locked up in the fuel, we arrive at the sun as the ultimate source of all our energy. What is the source of the apparently inexhaustible supply of energy of the sun is a question that we will not enter upon. Whereas the chain of transformations outlined above occurs within a short time interval, there is a very large gap in time, many millions of years, in fact, between the time when the radiant energy left the sun and the time when the fuel is taken out of the ground and burned under a boiler. The chemical energy in fuels has been aptly referred to as "fossilized sunlight."

The straight-line series indicated in the above sequence does not of course mean that each form of energy is changed one hundred percent into the next form in the series. According to the law of conservation of energy, no energy is ever lost, but there may be side streams diverting considerable amounts of energy from the straight-line flow. For example, in the transformation from heat energy to mechanical energy, about seventy-five percent of the en-

ergy is "lost as heat to the surroundings," or in other words the efficiency of the straight-line change is about twenty-five percent. The efficiency of transforming electrical energy to radiant energy in the form of light (assuming this to be the useful application) is only a few percent, and there again the remainder is dissipated as heat energy in the surroundings. In fact, we may say the only reason why each one of the steps in the chain is not one hundred percent efficient is that a certain amount of the energy is always stored as heat energy in the surroundings. This is partly due to imperfections in the mechanisms we employ, but also it is a consequence of a fundamental property of matter and energy which may be summed up in the statement that it is impossible to transform heat energy to any other form unless a temperature difference is available. As a corollary to this it may be stated that the availability of heat energy, or the extent to which it can be transformed to a form of energy capable of doing work (i. e., acting against external forces), depends on the temperature difference. These simple facts are the essence of the Second Law of Thermodynamics, which, like all hard, general principles, is very simple to state but often very difficult to recognize in application.

The ultimate result of all energy transformations is the storage of all of the original energy as heat in the surroundings. Since this cannot be converted into any other form of energy, the transformation chain may be said to be irreversible. Even though the energy is there undiminished in amount, it is forever lost to us as far as any useful application is concerned. Its availability is zero; that is, until some future scientist or engineer discovers a way of getting around the Second Law, or what amounts to the same thing, of dealing with the molecules of substances as individuals instead of dealing with a crowd.

Another significant fact about energy is that work and heat (which are best regarded as energy in the process of being transferred from one storage system to another) are the products of two factors—an intensity factor and a capacity factor. If the intensity factor is high, the capacity factor can be low for a given amount of energy transferred and *vice versa*. Thus in the transmission of electrical energy one can keep the quantity of electricity low and thereby save in cost of copper for transmission lines by using a very high voltage. This concept is particularly useful in considering heat energy where the intensity factor is the temperature.

Until 1900 we regarded the law of the conservation of energy as sacred and one of those very rare things in nature—a law with absolutely no exceptions. Any one who ventured the slightest hint that there might be exceptions would have been immediately ostracized from the society of reputable scientists and engineers. We now know that, whereas the law does hold exactly in all the ordinary concerns of life, there is one place where it is not sacred and that is within the atomic nucleus. Recent developments in the study of the nuclei of atoms indicate that in the future this fact may become of paramount importance, even in practical affairs. As a matter of fact, it has always been of tremendous importance to man, but he did not realize it and could not have done anything about it if he had. I refer to the fact that the ultimate source of all our energy is thought to be the conversion into radiant energy of the matter of which the sun is composed—a clear case of violation not only of the law of conservation of energy but of the conservation of matter as well.

It is now well established as a consequence of the theory of relativity that mass and energy, instead of being conserved, are actually interconvertible, the quantitative relationship being expressed by the equation:

$$E = M\ C^2$$

where E = energy, M = mass and C is the velocity of light. Since C is a very large number (3×10^{10} cm. per sec.), it can be seen that a small amount of matter can be transformed into a very large amount of energy. To be more specific, the destruction of one pound of matter would yield a little over eleven billion kilowatt hours of energy or something better than one-tenth of the total energy output of central power plants of the United States per year.

THE STORAGE OF ENERGY

Whenever the supply of energy from a given source, or the demand for energy, is variable or intermittent, it is desirable and sometimes essential to provide some means of storage. For example, the motor car needs energy for starting; the submarine uses stored energy when running submerged; electric generating companies have "off-peak" power available; steam boilers produce steam greatly in excess of the demand at certain times, and so on. This problem of energy storage is a very important one and one for which we have not yet evolved any very satisfactory solution. We have no means of storing energy which even approaches the concentration of energy that exists in a fuel like coal or a petroleum product. In the following table is given a rough order-of-magnitude comparison of the concentration of available energy on a volumetric basis:

Energy Concentration in Watt Hours

System.	Per cu. ft.*
Gasoline	95,000
Hydrogen compressed to 200 atmospheres	6,000
Electric storage battery	1,200
Water at 212° F.	290
Steam accumulator	200
Water at 100 ft. head	2.3

The use of electrical energy to decompose water under pressure with storage of the hydrogen is the only practicable means that we have at the present time for storage in the form of chemical energy in a fuel. This method, however, has found very limited application. The other storage methods, namely, as hot water, as water in an elevated reservoir, and as chemical energy in a storage battery, find considerable application but leave much to be desired from the standpoint of concentration, and for that reason are not suitable for storage of large amounts of energy.

REVIEW OF ACTUAL AND POTENTIAL SOURCES OF ENERGY

The various sources from which we may derive energy for useful application as heat or work may be classified as follows:

(1) Muscular energy of man and animals
(2) Winds
(3) Heat of earth's interior
(4) Temperature differences in the ocean
(5) Solar radiation
(6) Waves and tides
(7) Falling water
(8) Chemical energy of fuels
(9) Atomic energy

We may dismiss (1) from consideration because we are interested only in inanimate sources. The next two sources can be passed over with a brief mention, as neither one is important at the present time or seems to offer any great possibility for the future. Power from winds is, of course, quite extensively employed for pumping water in many small units, notably on farms and in Holland.

*Mechanical potential energy due to head of water and electrical energy from storage battery were assumed one hundred percent available. Chemical energy in fuels assumed [illegible] available. In case of stored heat, the theoretical availability (according to second law) above 70° F was assumed. The figure for the steam accumulator was based on an actual steam storage and the theoretical availability.

ALFRED S. ALSCHULER

On November 6, 1940, death came to Armour's most respected alumnus, Alfred S. Alschuler. Our nationally famous architect was a graduate of the class of 1899, and in 1904 was awarded the honorary degree of Master of Science by Armour Institute. He is survived by Mrs. Alschuler, three sons, and two daughters.

From the year of his graduation from the Institute, Mr. Alschuler took an active part in alumni affairs. Elected Vice-President of the Alumni Association in 1900, he served the association as President in 1910-1911 and 1926-1927. He was a member of the Board of Managers during the years 1912-1914, and served on the Advisory Board of the Alumni Association since its formation. Other offices were those of alumni trustee on the Armour Institute Board, and member of the Board of Trustees of the recently formed Illinois Institute of Technology.

Mr. Alschuler began his business career with Dankmar & Adler in 1899. From 1900 to 1903 he was associated with Trent & Adler, which in 1903 became Trent & Alschuler. In 1907,

Moffett Studios

he established his own firm. Mr. Alschuler is known as the first architest in Chicago to use reinforced concrete construction. He was awarded a gold medal for his plan and design of the London Guarantee & Accident Building, and received honorable mer tion for his design of the Lake-Mich igan Building.

Industrial buildings which he de signed include the Brach, Sexton Thompson, Mail Order, Dick, Amer can Radiator, Standard Sanitary Kuppenheimer, and Florsheim. Amon his synagoges are Sinai Congregatio Temple Israel, and the North Shor Congregation. Office buildings includ Westminster, Cunard, Utilities, Ch cago Mercantile Exchange, Finch ley's, Harvester, and Chicago Gar ment Center.

Mr. Alschuler served as trustee o the Illinois Institute of Architects, a member of the State Board of Arch tectual Examiners, treasurer of th Hadley School for the Blind, and a president of the North Shore Congre gation. He was a member of Ta Beta Pi fraternity, and the Arch tectural, Standard, and Northmo country clubs.

In the truest and deepest sens death has not come to Alfred S. A schuler. His example, his influenc and his many contributions to civiliz tion stand living today.

Due to the highly variable nature of winds, the storage problem stands in the way of any large-scale application, but even if this difficulty could be satisfactorily solved there still remains the fact that the energy concentration is very low in a moving air current. Assuming a wind velocity of thirty miles per hour, the maximum power available per square foot of wind-mill surface is only 0.18; a surface of 550,000 square feet would be necessary to generate one hundred thousand H.P. assuming one hundred percent conversion of the kinetic energy of air moving at this speed.

The temperature gradient as one descends beneath the earth's surface varies with locality from twenty to one hundred seventy feet per degree Fahrenheit, with fifty to sixty feet as a fair average. On the average, therefore, the normal boiling point of water would be reached at a depth of one and one-half miles. Holes have been dug in the earth to greater depths than this and there is no definite limit to the depth that may be reached. In a few places, notably in Italy, steam for industrial purposes is being drawn from wells. Many years ago, Sir Charles Parsons, a well-known English engineer, seriously proposed the sinking of a shaft twelve miles deep to tap the earth's interior heat, but no such attempt has ever been made or is likely to be given serious consideration today. The question of how to secure enough heat transfer surface to permit the generation of any considerable amount of power is only one of the many problems that would have to be solved, even supposing that the tremendous difficulties involved in sinking such shaft could be overcome.

Power from Temperature Differ ences in the Ocean. Though this seem at first thought like a rather fantasti scheme, yet it is based on sound ther modynamic principles. It also de serves more than passing mention be cause it was actually put to the tes by the French engineer, George Claude, who had been highly success ful in other fields. A considerabl amount of money was expended in th trials which took place near Cuba As far as the author is aware, thes trials were a complete failure from practical standpoint and the end o the story has never been made publi Claude was convinced that his schem was commercially feasible and he an nounced plans in 1930 for a twenty five thousand kilowatt plant to b

erected near Santiago, Cuba. The plans, however, were never carried through. Let us review briefly some of the underlying facts and principles.

In tropical waters, surface temperatures are eighty to ninety degrees Fahrenheit, and at a depth of three thousand feet the temperature is constant at about thirty-nine degrees Fahrenheit, the temperature of maximum density of water. From elementary principles we know that power can be developed from stored heat energy whenever a temperature difference exists. The total difference in this case is only forty degrees Fahrenheit and this would probably be reduced to an effective difference of not more than twenty degrees for the prime mover when allowances are made for necessary thermal heads in heat-exchange apparatus. This may be compared with a difference of about seven hundred degrees Fahrenheit, or thirty-five times as great, in a modern steam plant. With so small an intensity factor the capacity factor would have to be correspondingly large, which indicates that the size of the equipment for a given output would be many times that of a more orthodox steam plant. The practical problem of conveying very large volumes of cold water to the surface from a three-thousand-foot depth, with expenditure of only a fraction of the power developed and preventing appreciable rise in its temperature would be enough to daunt any engineer, but it was partially solved by Claude after a few disastrous attempts.

Claude intended to use the warm water itself as the working fluid in the engine, but this hardly seems feasible because of the low pressures involved. It would seem better to use a working fluid with a much higher vapor pressure even though a further loss in thermal head would occur in heat exchangers. The whole scheme seems utterly fantastic from any economic standpoint at the present time but can we be certain that it will not become a practical reality a few hundreds years hence?

Before leaving this source of energy, passing mention might be made of the related scheme (also championed by a French engineer) of utilizing the ocean temperature difference in the arctic regions, where the heat source would be the ocean water just under the surface at a temperature of thirty-two degrees Fahrenheit, and the heat "sink" would be chunks of salt-ice eutectic mixture at six degrees Fahrenheit.

Solar Radiation. The amount of radiation reaching the earth's surface from the sun naturally varies with a number of factors, but on a clear day a surface perpendicular to the direction of the radiation receives, on the average, about 0.12 horsepower per square foot or approximately three million horsepower per square mile. Assuming eight hours per day of sunlight of this strength, an area of fifty square miles would supply all of the present power demand of the United States. There is, however, a tremendous gap between the possibilities and the practical realization, and only a few feeble attempts have been made to close the gap. The chief difficulties are: (1) the large area required for any sizeable plant; (2) the intermittent nature of the supply and lack of a good method of storage; (3) the changing position of the sun relative to the earth; (4) the low availability of the energy if turned into heat (eighteen percent for average heat-source temperature of two hundred degrees Fahrenheit and average condenser-temperature of eighty degrees Fahrenheit). An idea of the difficulty caused by the low concentration of solar energy may be had from the fact that a modern steam boiler generates about four horsepower per square foot of heat-transfer surface, or an energy concentration almost thirty-five times as great as that in solar radiation.

The major portion of all solar radiation falling on the earth is converted to heat at the temperature of the atmosphere and is wholly unavailable. The following means might conceivably be used to convert solar energy to a form of energy available for work: (1) photo-synthesis; (2) photo-electric cells; (3) heat engines using a fluid working substance; and (4) thermocouples (also essentially a heat engine, but using electrons as the "working substance"). A small proportion of the radiation from the sun is continually being stored as chemical energy through the process of photo-synthesis carried out by green plants. It is this process which made possible the stores of bottled sunlight that we are now obtaining from fuels, and it may have undeveloped possibilities for the continuous production of raw materials that can be processed to yield motor fuels. Photo-synthesis as practiced by the green plant is a very inefficient process in the sense that under the best conditions only a few tenths of one percent of the radiation falling on a plot of ground is converted to chemical energy. There is no man-made device at the present time which can improve on this. However, we know next to nothing about the mechanism of the process, and the next step in our program should be a long-range research effort by a number of cooperating scientists in an attempt to learn something about photo-synthesis.

The photo-electric cell is also a very inefficient device as far as conversion of total radiation from the sun into electrical energy is concerned, but who can say how much this might be changed by further research?

The development of solar heat engines has intrigued a number of inventors, and small units have been built and successfully operated for both water pumping and refrigeration. The fuel cost is, of course, zero, but the fixed charges are relatively high, and at the present time solar heat engines could not possibly compete with fuel-power plants or water-power plants except in special regions far removed from these sources of power. Dr. C. G. Abbot, a pioneer in this field, believes that solar power can be generated at the present time at not over one-half cent per horsepower-hour. Before leaving the subject, attention should be called to the Godfrey L. Cabot fund established at the Massachusetts Institute of Technology for research on utilization of solar radiation. Research is being conducted along all four of the lines outlined above, and many interesting results can be expected, even though they may be of little immediate practical importance in power development.

Waves and Tides. Even though large potential amounts of power are undoubtedly available in waves, we shall dismiss this source entirely from consideration because of its extreme variability. Tides on the other hand are quite regular and constant in nature, and offer a means of power generation which is entirely feasible from a technical standpoint, but probably not from an economic one at the present time. The principle is, of course, very simple and scarcely needs discussion. Any difference in water level can be utilized to generate power; the chief difficulty in the case of the difference produced by the moon (we might refer to tide power as lunar power, and this would certainly seem most apt to those who regard the recent governmental venture in this field as something akin to lunacy) is that it is so small that enormous volumes of water must be impounded to obtain a sizeable block of power. This means costly dams and also low-head turbines whose cost per power unit is high, with the net result that the fixed charges on such a plant are high. In this case, part of them cannot very well be assigned to some other function such as navigation or flood control.

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INDUSTRIAL HEALTH

By

C. O. SAPPINGTON

Industrial health is a cooperative undertaking. This means that many different types and groups of people are interested in and concerned with it, including the employer and employee, research worker, physician, safety and industrial hygiene engineer, not to mention the insurance company, the lawyer, director of personnel and labor relations, public relations personnel, the nurse, psychologist and psychiatrist. At the outset, it is advisable to discuss the scope of industrial health work and the meaning of the terminology used in connection with industrial health problems.

Industrial health is a broad term and obviously includes all methods and practices aimed at the supervision and maintenance of a high level of personal health among industrial workers. The complexity of the field is thus obvious, particularly when it is realized that any factor which may adversely affect health becomes a problem for concern and investigation. In the very beginning, it should be noted that the essence of industrial health lies in the *prevention* of trouble. This conception necessarily broadens the field of approach and application of industrial health procedures.

A distinction should be made between the general practice of industrial health and the general practice of industrial medicine and surgery. This distinction has already been made in practice in most instances. By and large, the practice of industrial medicine and surgery is limited to the diagnosis and treatment of disease and injuries. This, of course, is entirely the responsibility of the physician and in most instances, the physician is mainly occupied with curative procedures. There is, however, what is called preventive medicine in industry. This directly applies to industrial health work, and in it the physician is used for certain procedures which will be discussed later.

Industrial hygiene engineering is an integral part of industrial health work, which is specifically concerned with certain factors in the working environment which might become health hazards under certain circumstances. Such factors include dusts, gases, vapors and fumes; temperature, humidity and air motion; the kind of illumination; type of ventilation used, both natural and artificial; the physical setup of equipment; the types of materials handled with particular reference to their becoming potential health hazards.

It is the job of the industrial hygiene engineer to use various types of instruments for the collection of dusts, gases, vapors, and fumes, and to determine the quality and quantity of these materials in the breathing atmosphere; to estimate the kind and intensity of illumination; to make measurements with reference to the efficiency of exhaust ventilation systems and natural systems; to make observations relative to temperature, humidity and air motion; and otherwise to give attention to the various factors in the environment which might bear directly on the health of workers. By comparing what the conditions are with the various standards, the industrial physician has information which can be used as the basis of recommendations for control of any hazards which may exist, and also in checking the physical reactions of employees.

It is also important to consider the possibility of accidental injuries, and therefore safety engineering becomes a very definite and important phase of industrial health. It is the duty of the safety engineer to make inspections and to point out what potential injury hazards exist with respect to the running of machines, the handling of materials, and various other methods and practices in industry which have to be observed and analyzed for the possibility of injury hazards.

Another important phase of industrial health is sanitation and housekeeping. Within this category come the importance of keeping the workplace clean and orderly throughout the working period, and the provision of proper sanitary facilities, such as shower baths, washrooms, toilets, and the like.

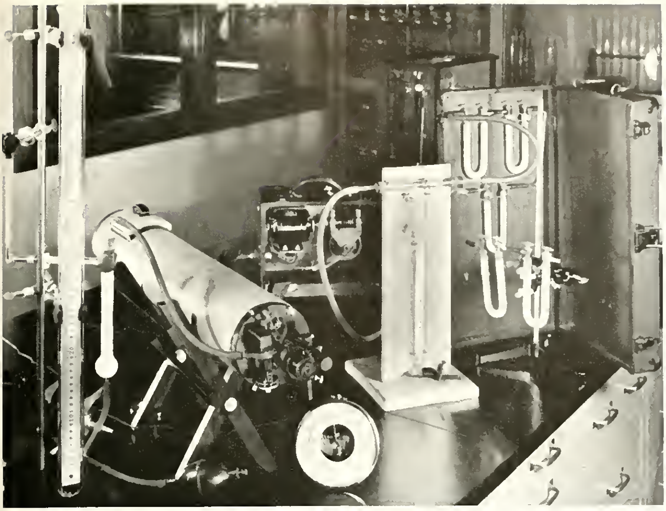
THE FOUR-POINT PROGRAM

Now let us consider a sample survey in a relatively small plant of approximately 175 employees, including in this survey the following four different types of observations:

I. Safety Engineering Control
II. Industrial Hygiene Engineering Control
III. Sanitation and Housekeeping
IV. Health Control

Safety Engineering Control—During the safety inspection, it was discovered that there were a number of unsafe practices, such as the use of abrasive wheels without protection for the eyes; material being so placed that it constituted a slipping and tripping hazard; the use of punch presses without proper guards; and the unsafe use of a freight elevator. In addition to specific suggestions in each instance regarding unsafe practices, the following recommendations were made:

1. First aid dispensary adequately supplied and run.
2. Analysis of accident experience during the past ten years followed by specific recommendations.



Courtesy Zurich Insurance Co. and E. H. Sargent & Co., Chicago

Portable apparatus for determining concentrations of various vapors and gases in industrial atmospheres.

Left—Interferometer. Right—Silica gel adsorption tubes connected to flowmeter and motor pump suction apparatus. Lower center—Aneroid barometer.

3. The appointment of a plant safety committee.
4. Periodic inspections and investigations of accidents by safety committee, physician and nurse.

Industrial hygiene engineering control—The industrial hygiene inspection showed among other things, a deficiency in the proper type of lighting; lack of providing proper temperatures, humidity and air motion; occurrence of various types of dusts and vapors in the air; and in various departments, the handling of materials known to have caused skin irritation. The following specific recommendations were made:

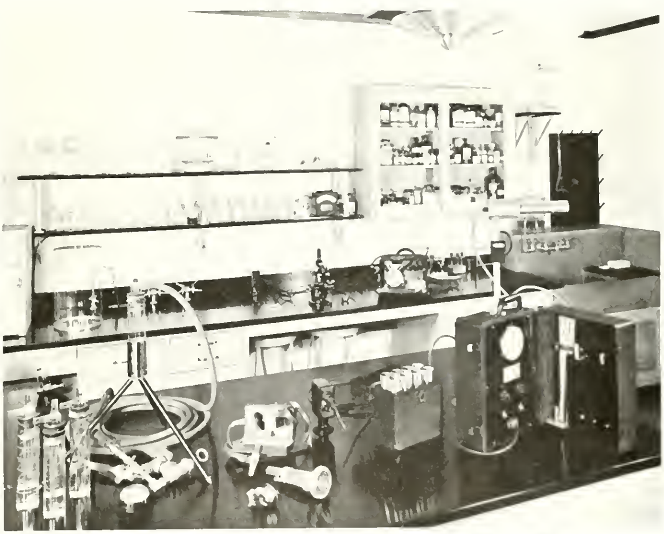
1. Measurements of lighting in various departments, with the establishment of proper standards.
2. The measurements of temperature, humidity and air motion in various departments, and the establishment of proper physical conditions of atmosphere.
3. Measurements of vapor concentrations and dust concentrations, with remedying of conditions as found necessary.
4. Provision for the use of rubber gloves in various departments where the materials handled are capable of producing skin irritation.

Sanitation and housekeeping—Observations with respect to sanitation and housekeeping showed that aisles and walkways were very often blocked; refuse disposal program inefficient; floors, toilets and washbowls in dirty condition; employees eating at work benches or in workrooms; and dirty and obsolete drinking fountains.

Specific recommendations were made in each instance with respect to the control of sanitation and housekeeping conditions.

Health Control—With respect to the health control program, the following recommendations were made:

1. Obligatory physical examinations of all new employees. (Using adequate forms and standards of acceptance related to the actual industrial exposures in the working environment).
2. Voluntary physical examinations of employed persons on a privilege basis, with employer's guarantee of no discriminatory measures.
3. Compulsory periodic examinations (as found expedient) on all those employees exposed to health hazards, as determined by industrial hygiene engineering studies.



Courtesy Zurich Insurance Co. and E. H. Sargent & Co., Chicago

Portable apparatus for determining concentrations of dusts and fumes in industrial atmospheres. Left—Standard size impinger tubes with connection to ejector suction device for continuous sampling of dust. Center—Konimeter, especially for study of "grab" samples of dust in low range concentrations. Right—Electric precipitator for continuous sampling of dusts or fumes.

4. Follow-up procedures on all examinations when needed, for special advice concerning correction of physical defects, cooperation with family physician, and other similar measures.
5. Simple but complete record system for the recording of examination data, first aid calls, absenteeism records, accidents and illnesses.
6. Provision for full-time registered nurse in charge of simply-equipped dispensary for first aid to accidents and illness, and the keeping of records.
7. Provision for part-time industrial physician with pre-arranged hours at plant dispensary, for consultations, examinations, and plant inspections.
8. Health education program for employees, carried on through the physician and nurse, and also through a plant health committee.

What the Engineer Can Do

It is obvious that the component parts of an industrial health program involve training in different

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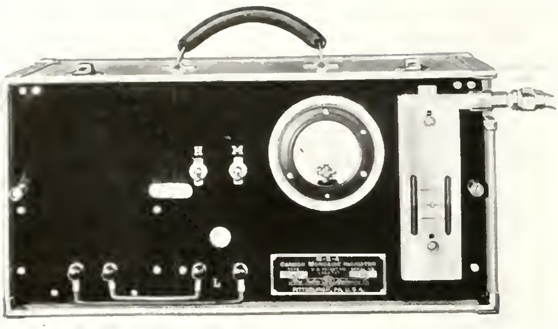
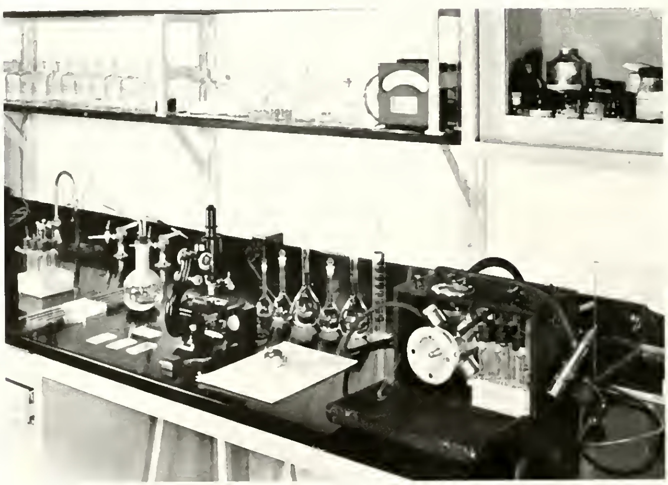


Courtesy Mine Safety Appliances Co., Pittsburgh

Portable continuous carbon monoxide indicator for sampling mine and factory atmospheres.



Courtesy Zurich Insurance Co. and E. H. Sargent & Co., Chicago

Laboratory and portable equipment for dust determinations in industrial atmospheres.

Left and center—Midget impinger tubes, pipettes, counting cells, microscope, counter, and dilution flasks.

Right—Portable midget impinger dust sampling apparatus.

AROUND THE CORNER WITH FM

By

ARTHUR W. SEAR

Newspaper stories and magazine articles have heralded frequency modulation as a revolutionary development in radio broadcasting. However, it is in some of the technical aspects rather than in basic underlying principles that this newcomer in the field of radio is revolutionary. Neither does it follow that there will be a rapid or complete change in radio broadcasting as we know it today. What we may expect is a leisurely transition period, during which both frequency modulation and the older amplitude modulation will find their proper places in the complete field of communication.

Frequency modulation, as developed by Major E. H. Armstrong, has certain advantages which assure it a permanent place in radio broadcasting. Chief of these advantages is the suppression of extraneous noise and freedom from static. One critic has said that it is the only radio system that can broadcast silence, and this feature is one of the characteristics noticed when a listener first tunes in an FM station. When the studio is quiet, the radio receiver is silent; then the announcer speaks and it seems as though he is in the room, quietly talking to you. In addition, this relatively quiet operation is accomplished in a wave band which interference from automobile ignition systems and other similar disturbances has made almost useless.

The freedom from static and noise is further enhanced by the absence of interference from other stations. The nature of the FM signal is such that a strong carrier inhibits a weaker one. Even in areas where signals from two stations on the same frequency could be received, if the carrier of one is twice as strong as the other, the weaker signal is suppressed to insignificance. In the rare cases where two stations, operating on the same frequency, produce signals of approximately equal strength, a directional receiving antenna system is sufficient to allow the FM receiver to select one station and reject the other.

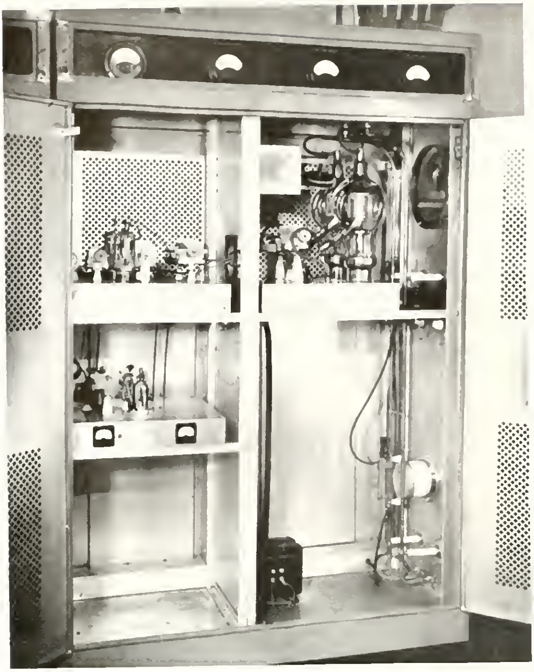
The lack of background noise in FM reception permits taking advantage of another inherent improvement over the older method. This is the ability of the system to handle a wide range of audio-energy. Since reception is quiet, the soft playing of a soloist comes through without sinking below the noise level, while on the other hand a fortissimo passage of a large orchestra is reproduced without distortion caused by over-modulation. Although there are practical limits which determine the audio-energy range which may be used, the fact that the amplitude of the carrier is independent of the audio-signal relieves the operator of constantly "riding the gain" to prevent over-modulation.

The elimination of extraneous noise is particularly important in connection with the transmission and reception of the wide band of audio-frequencies essential to a high fidelity system. Wide band transmission can be obtained with amplitude modulation; however, in the standard broadcast band the assignment of stations to channels ten kilocycles apart makes it necessary to limit the audio-frequency band to prevent interference with adjacent carriers. Since FM broadcast is assigned to a high frequency band, enough space between channels has been allowed to permit transmission of audio-frequencies up to fifteen thousand cycles per second without interfering with other stations. The whole development of FM broadcast has been made with high fidelity in mind, and as a result the striking realism of programs over this system has become one of its principal features.

The assignment of FM to a frequency band extending from forty-two to fifty megacycles is somewhat of a mixed blessing. The use of a carrier at this high frequency simplifies the transmission of high fidelity programs, but these short waves are not reflected from the ionosphere, so transmission is limited to a range not much greater than the distance a searchlight beam can be seen. This means that an FM station will serve a local region within a radius of from fifty to seventy-five miles. However, the thirty-five available channels can be assigned over and over again to stations in different parts of the country with no danger of interference and thus a large number of stations can be accommodated.

Since the frequencies that have been assigned to FM broadcast are useful only for local transmission, rural regions and sparsely settled parts of the country will most likely continue to be served by the regular broadcast stations for a long time. Technically it is possible to set up remote automatic transmitters and have the program relayed on other wave bands to these local transmitters for broadcast. The cost of small local transmitters is relatively low, so that in the future some such arrangement may be adopted.

Nearly everyone thinks only of radio broadcast when the subject of radio is mentioned. As a matter of fact, some of the most important uses of radio are in fields other than broadcast. Communication with ships at sea, radio aids for airplane traffic, point-to-point communication, direction and control of mobile police units, and liaison service for military and naval forces, are some of



the uses for radio which are important but which are not of everyday interest to the average individual. The use of FM will be adapted to some of these services. The Connecticut state police are installing an FM system for two-way communication, while the Chicago police are experimenting with FM with the same end in view. The use of FM by military and naval forces seems logical. The ability to maintain communications through heavy static and interference particularly recommends it for this service. Equally important is the ability of the stronger signal to suppress weaker ones, and thus prevent the enemy from "jamming" the channels to interfere with orders and reports.

On the other hand, FM does not appear to fit into the scheme of radio communication as used by airplane transport. The operation of the radio range signals, or beams, is based upon the strength or amplitude of the signal received; consequently, the use of amplitude modulation presents the simplest and most direct solution to the problem. Radio direction finding by means of a direc-

Above: Amplifier and I K. W. Output Stage of the Zenith FM Radio Station W9XZR

Right: Master Control Position and Turntable of Station W9XZR Zenith Radio, Chicago

Photographs by George A. Raymond, I. I. T., '42

tional receiving antenna, such as a loop, works out more easily with an amplituded modulated receiver. Both the radio range and radio compass operate more satisfactorily at the lower radio frequencies, and at the lower frequencies there is not room for the wider band required for FM, even if there were some advantages to this system. In the extremely high frequency channels used by the air-lines, atmospheric disturbances are not serious, and since the ignition systems of the airplane engines are perfectly shielded, amplitude modulation is satisfactory.

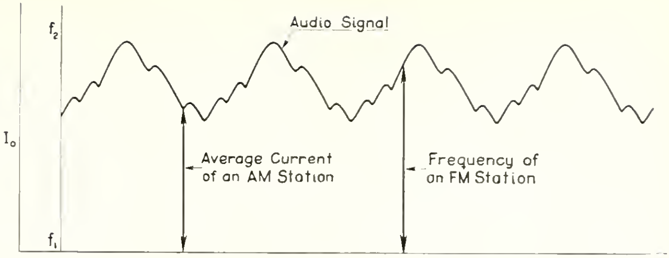


Fig. 1. Variation of Antenna Current When Modulated by An Audio Signal

Any attempt to explain the intricacies of frequency modulation should perhaps start with a review of radio in general and the phenomenon of radiation in particular. Radio communication is based upon the radiation of electro-magnetic energy by the transmitter. This is the same form of energy that we know as light, and if our eyes were sensitive to the long waves of the radio stations, the transmitting antennae would appear as sources of light, since energy is radiated from them somewhat after the manner that light energy emanates from the filament of an incandescent lamp.

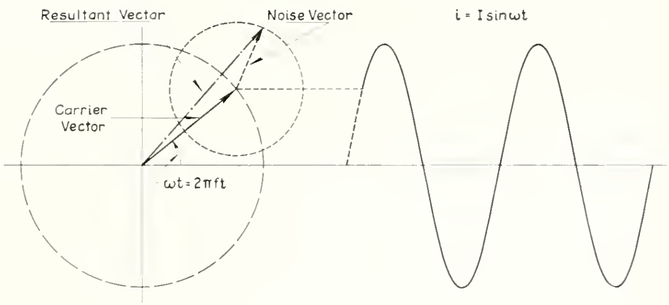


Fig. 2. Vector Representation of Signal Current and Noise Current

Efficient radiation can be accomplished only at high frequencies, that is, at frequencies that are higher than the ear can respond to. Consequently, a high frequency carrier of radiated electro-magnetic energy is used to convey the message. The first type of signalling was accomplished by turning on and off the carrier, just as one would turn on and off a flashlight, that is, flashing the light according to a code, as is done in telegraphic communication. If, however, the intensity of the carrier is changed to conform to the fluctuations of electric current from a microphone, then voice frequencies are superimposed upon the carrier. This is essentially what takes place in a transmitter using amplitude modulation. The intensity of the carrier, corresponding to the intensity of the light beam, is caused to vary, and since the radio receiver is sensitive to the variations in intensity, the transmitted signals are reproduced in the loud speaker of the receiver. Frequency modulation would correspond in a rough way to changing the color of our light source without changing the intensity. In this method, the carrier has a constant energy level, but there are changes in frequency, corresponding to slight shading in the color of the light source, that convey the information to the listener. To receive this type of modulated carrier, a special receiver must be used. That is, we must have a receiver which is sensitive to variations in frequency of the carrier wave rather than to variations in its intensity. By keeping the source of energy at a constant intensity, and varying its frequency, there is less likelihood of extraneous signals or noise interfering with the desired station.

Figure 1 illustrates the manner in which the audio-signal is superimposed upon the antenna current of the transmitter. The amplitude-modulated station will have a current which changes so that the envelope of the radio frequency current corresponds to the audio-signal. The frequency-modulated station will have a frequency that changes to conform to the audio-signal. FM carrier frequencies are so high, forty to fifty million cycles per second, that a frequency change of one hundred and fifty thousand is a comparatively small percentage of the total.

The instantaneous value of the current flowing in the antenna of a radio transmitter can be represented by a revolving vector which at a particular instant may have a position as shown in Figure 2. When there is no modulation at the transmitter, the antenna current of either an AM or FM station has an unvarying average value and a con-

stant frequency. If the carrier of the AM transmitter is modulated, the antenna current can be represented by a vector which changes in length but revolves at a constant angular velocity. Modulation of an FM carrier can be represented by a vector of constant length but of varying angular velocity, or frequency. In the case of AM a variation in the length of the vector may be thought of as the degree of modulation.

The maximum linear change that the magnitude of the vector can have is for it to vary from zero to twice its average length. This change corresponds to one hundred per cent amplitude modulation. The current in the receiving antenna follows the same pattern as the current in the transmitting antenna, except that additional currents may be introduced by static or interference. The presence of extraneous currents results in undesirable noise in the loud speaker. If we consider noise as a random vector which can combine with the revolving vector in any conceivable manner, the length of the carrier vector can be appreciably altered by the addition of this random noise. It is perhaps unconventional to consider a random noise vector added to a vector which represents a particular frequency. However, if we think of the noise vector as consisting of all frequencies, there will be present in the noise current

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ENGINEERING DEFENSE TRAINING

ILLINOIS INSTITUTE REGIONAL CENTER

The Federal Government has asked Illinois Institute of Technology to cooperate in a plan to provide courses intended to meet the shortage of engineers with specialized training in fields essential to national defense. The plan contemplates intensive engineering courses of college grade, and the subjects will depend upon our estimate of needs in this territory, after conferences with the industries. The courses contemplated include Machine Design; Tool Design; Design of Jigs, Templates, and Fixtures; Advanced Engineering Drawing; Advanced Structural Design; Diesel Engine Design and Testing; Welding Engineering; Metallurgy; Radio Design and Testing; Materials Inspection and Testing; Testing of Explosives; Production Engineering; and Production Supervision. Some courses may be combinations or subdivisions of those mentioned above, and there may be others not listed that relate to the defense program as it affects industries, the civil service, or the armed forces. The courses are not *vocational* and do not overlap such courses now in operation or in prospect.

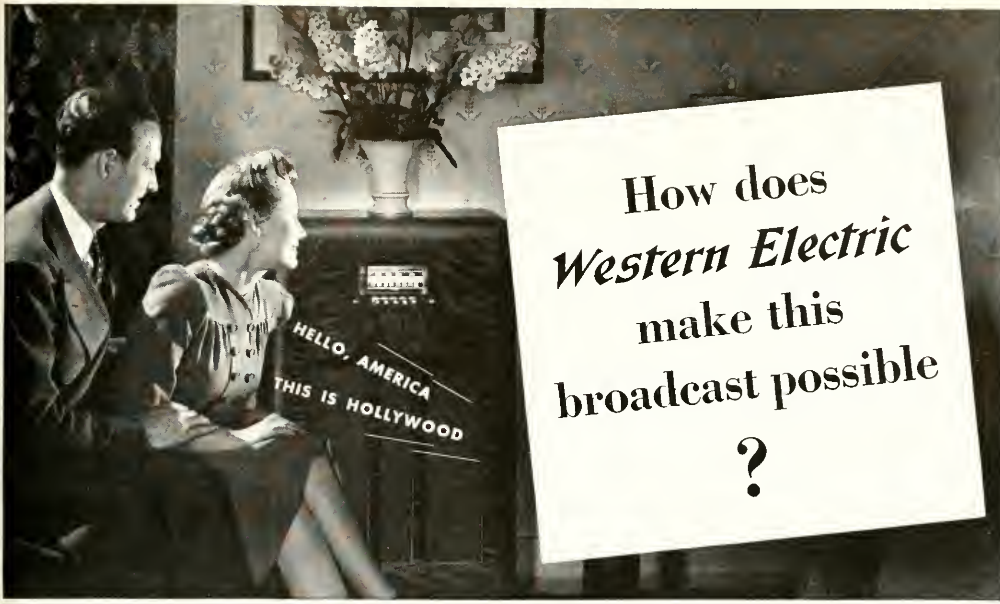
Eligibility for admission is judged in individual cases. The basis is ability to handle work on the college level in the particular course. All or part of a college course is a desirable qualification, but may not be necessary in all cases. Registrants may or may not be now employed.

In most cases, the courses will be of fifteen weeks' duration, with classes meeting twice weekly for three-hour periods, or three times weekly for two-hour periods; nights, Saturday afternoons, or at other times outside working hours of students. The classes will be at the South Side and West Side campuses of the Institute; in some cases at plants of cooperating industries; and, where necessary, in rented space.

No tuition fees are paid by the students. Their only costs will be for text books and drawing instruments needed for some courses. Individual classes will be kept small for maximum efficiency in teaching. The same subject may be given in parallel to more than one class. It is expected that class work will begin about January 1, 1941, and if necessary at monthly intervals thereafter, but not later than April 1. A federal appropriation reimburses the Institute for the costs of the program. Under the existing appropriation act, the program ends June 30.

President H. T. Heald is regional adviser in the engineering defense training area which includes all of Illinois, the southern portion of Wisconsin, and the Chicago industrial area in the northwestern portion of Indiana. Professor J. B. Finnegan is director of the E. D. T. courses at Illinois Institute of Technology.

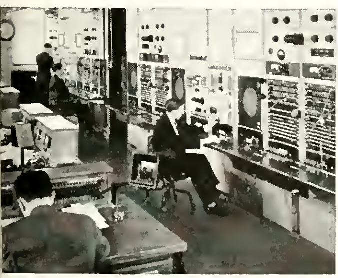
It is requested by the U. S. Office of Education that widespread publicity be given to the program. Alumni of the Institute are invited to bring the plan to the attention of qualified persons.



In the development of radio—that important influence in modern life—Western Electric equipment has played a big part.

Here are the main routes of the high quality Bell System lines employed in broadcasting service. The "network broadcast" travels over these wires.

The thousands of miles of wire and cable, the poles, the countless items of apparatus were supplied by Western Electric, manufacturer and purchaser for the Bell System.



Telephone company "control offices" like this one, Western Electric equipped, are located at important cities. They switch the network program to selected broadcasting stations.

To keep the program at full brilliance, Western Electric vacuum tubes at "repeater stations" amplify the electrical impulses with complete fidelity.

So, out of the telephone art has come much of broadcasting's plant. This apparatus is made by Western Electric with the same skill as your Bell Telephone.

Western Electric

... is back of your Bell Telephone service

COOPERATIVE CURRICULA

LEWIS INSTITUTE OF ARTS & SCIENCE

The Illinois Institute of Technology will offer Cooperative Curricula in Business Administration and in Industrial Management at the Lewis Institute Division, the first group starting February 3, 1941. This course is open to both men and women.

Students will alternate between school and employment in business and industry as they do in the popular "Co-op" course for mechanical engineers at the Armour Division. Upon satisfactory completion of the fifteen terms of school work and a similar period of employment, the degree of Bachelor of Science will be conferred.

This program is being organized in an attempt to provide a means for energetic and ambitious high school graduates to alternate between training on the job and related college work. Students will be enabled to earn a large part of their college expenses by working half time and yet may complete a four-year college course in five years. Cooperating business enterprises will be provided with a selected group of men and women whose services will be valuable during their undergraduate years and who will be available for continued employment upon graduation.

The school year will be divided into six alternating periods of eight weeks each. Upon being admitted, the student will secure a business position after consultation between the Institute and the cooperating employers. A company may offer this opportunity to young men and women already in its employ who have shown unusual ability, and who have the necessary scholastic qualifications to meet the requirements of the Institute.

Students for the new cooperative course will be very carefully selected. Attention will be given to data obtained from individual interviews, to the student's attainment in high school, and to entrance tests. Admission to the course will be limited to those who possess both scholastic ability and qualities of leadership.

During the time they are employed, students normally receive the prevailing rate for the kind of work done. The wages paid will in turn be used by the students to meet their obligations to the Institute. Students are not permitted to change their business positions without the knowledge and consent of the Co-ordinator.

The training for business administration has been organized for the purpose of educating young men and women for service in the fields of retailing, wholesaling, office or personnel management, advertising, and similar positions. Besides fundamental studies in science, economics, and the humanities, the curriculum provides specialized courses in salesmanship, purchasing, marketing, advertising, office management, and other fields offering definite training for those who desire employment in business enterprises.

The training for industrial management emphasizes the principles of management that are commonly applied to the manufacturing industries. In addition to the basic studies in science, economics, and the humanities, this curriculum offers specialized courses in motion and time study, factory layout and equipment, production management, cost control, and industrial marketing, as well as others of special usefulness to students employed in industrial organizations.

There are many excellent advantages accruing to the student from pursuing these courses. Among them is the achievement of a broader and more realistic education resulting from the correlation of principles learned in college work and personal participation in their application on a job. The student also has the opportunity to earn part of the expenses of his college career while getting experience in his chosen field of business. At the end of his college training, he will have the advantage of being able to present actual experience to a prospective employer. Moreover, it is expected in many cases, he will have found his employer by the time of graduation. He may reasonably expect to hope for more rapid advancement in his chosen vocation after graduation as a result of this combination of training and business experience.

This cooperative program does not duplicate any other educational offering in the metropolitan area. No other college is presenting a five-year cooperative curricula in business administration and in industrial management leading to a Bachelor's degree. In still another way it is non-competitive in that it will be taken advantage of by many who otherwise would not go to college.

Armour College of Engineering has brought about a correlation between higher education and industry in a systematic way by its cooperative course in mechanical engineering. Lewis Institute of Arts and Sciences will bring about the same correlation between higher education and business through this program as set up. The Institute has long attempted to serve students who found it necessary to work and attend college on a part-time basis. It has sought to offer courses designed to fit the needs of this group. This cooperative program is felt to be an important advancement, because it

(Turn to page 28)

BLENDED 33 TIMES TO MAKE ONE GREAT BEER!

First in the Homes of America—and the Largest Selling American Beer in the Rest of the World!

It takes 33 separate brews to put such flavor, such smoothness, such unvarying goodness into a single glass of BLUE RIBBON!

The finest coffee is *blended* . . . and so is this finest of *beers*—Pabst Blue Ribbon!

Try a glass of Blue Ribbon today. First enjoy the *look* of it—the clarity, the sparkle, the billowy head. Then enjoy your discovery of what beer flavor and beer smoothness can be!

In that glass—and in *every* glass of Blue Ribbon—is a blend of not two, or five, or ten . . . but 33 separate brews from 33 separate kettles.

And each brew is as fine as 96 years of skill, the 28 Pabst scientists, and Pabst ingredients can make it!

An expensive way to brew? Of course! But that's what makes Blue Ribbon *America's Premium Beer*, with a smoothness that is unique . . . and a goodness that never varies.

Sometime today, have the pleasure of meeting Blue Ribbon.

It's the **BLEND** *that Betters the Beer*

Try **Pabst Blue Ribbon** *and Prove it*

COOPERATIVE CURRICULA

(From page 26)

not only offers the educational service of helping the student to find appropriate employment, but also assumes a large measure of responsibility for correlating formal education in college with the work of the student in his chosen vocation. Definite attempts will be made to unify these two factors in a vital way. Heretofore, to a large extent, the school has provided courses *after* the student has found employment wholly on his own initiative. It is believed that the plan provides a substantial basis for graduate work later for major executives.

KATHRYN JUDKINS

Monfort Studio

An advisory council for the program has been formed of administrative officers of the Illinois Institute of Technology and representatives of business and industry. The official Co-ordinators in the program are Mr. L. J. Lease and Miss Kathryn Judkins. They are prepared to receive applications for admission to the courses. One-half of those who are accepted will begin their college work February 3 in classes to be conducted at the West Side campus. The other half will occupy their positions of employment.

This project, sponsored by the Illinois Institute of Technology, consolidates the resources of its branches in socially important ways. By drawing generously upon the material, instructional, and administrative resources and facilities of both branches, it has been found possible to set up and create this cooperative educational enterprise.

THE BOOKSHELF

By

ELDER OLSON and JOHN DE CICCO

Ernest Hemingway's latest novel, *For Whom the Bell Tolls* (Scribners), is a beautiful and moving book. Mr. Hemingway has retained and even developed further his gift for vivid and forceful diction; he has extended somewhat the range of his conception; and, in short, he remains one of the most interesting figures in contemporary American literature, and this newest book is worthy of him. One can, indeed, one *should* say all these things freeheartedly and ungrudgingly; but to say much more than this is to caricature, I fear, both Mr. Hemingway's talent and his achievement. Critics have, of course, said more than this. An oddly flamboyant folder before me flaunts the hysterical adulation of critic after critic—Canby, Adams, Sherwood, Dorothy Parker, Gannett, Hansen, Howard Mumford Jones, Fadiman, Vincent Sheehan—all shrieking 'for all time', 'for all mankind', 'our best writer's best book', and so on. I wince a little for Mr. Hemingway. An artistic giant no doubt feels utter fury when he is treated as a charming pygmy; we can get a presentiment of what he must undergo when we hear Beethoven, for example, spoken of as a 'composer of exquisite bagatelles'; but if there is any worse anguish it is that suffered by a conscientious minor artist whom excited critics are trying to stretch to the stature of a Titan. And Mr. Hemingway *is* conscientious; and he *is* minor.

The first of these two predications is obvious enough; the second may demand some discussion. *For Whom the Bell Tolls* illustrates my point very nicely. The diction is that of a literary virtuoso who can do anything in words; Mr. Hemingway can construct a continent, an ocean, a sunset, anything you want, practically at a blow, practically with a single stroke of the pen; and he can do this almost *ex nihilo*. Most writers can be caught lugging their literary paraphernalia onto and off the stage; if they make anything magical happen, it's all done with the aid of mirrors, and you can *see* the mirrors; the whole stage in fact glitters with literary artifices; but Mr. Hemingway takes a handful of plain English, gestures, and you have the civil war in Spain, the retreat from Capparetto, or whatever the magician desires you to see.

From this standpoint, there would be some sense in saying that Mr. Hemingway can write Tolstoi's head off, for the Russian is far less graphic. But there is a difficulty. When all the decor is finished, when the characters are vividly before us —*vividly* in a purely physical sense —then Mr. Hemingway can do little more; the rest is a commonplace performance. In this latest work, for instance, the author employs an intellectual framework which is not a whit better than that of any of the hack magazine novels on the Civil War in Spain or the Nazi revolution in Germany; but his amazing stylistic genius can hide every weakness and transform the commonplace into the miraculous. You can get an idea of how much depends upon diction here by translating any paragraph into French, German, or any other language than Hemingway's English; the effect is immediately lost.

As a consequence of his primary weakness and strength, Mr. Hemingway's major characters in the new novel, like those in his earlier works, remain abstractions; his minor characters, as always, are sharply and absolutely drawn. His plot, as always, is, like the Irishman's coat, a tissue of holes; his episodes are amazing. The whole always falls short of perfection, the part always achieves it; and the achievement in this new work is so extraordinary that you will read of Pilar and Pablo — especially Pilar's appalling narrative—and you will wonder why I am captious about Maria and Jordan.

ELDER OLSON.

Mathematics and The Imagination. By Edward Kasner and James Newman, with illustrations by Rufus Isaacs. New York: Simon and Schuster, 1940.

Edward Kasner, Adrian Professor of Mathematics at Columbia University, and James Newman, mathematical amateur (I use the term in its original sense), have written a book which is outstanding in its gift for simplification. This unusual quality of explaining the esoteric concepts of mathematics in simple and understandable terms attests the ability of Messrs. Kasner and Newman.

Modern mathematics, far removed from its elementary aspects, is here displayed in the form which best reveals its beauty and simplicity. Misty philosophical discussions are creditably avoided. Instead, by always clear and often witty exposition, the authors lure their reader through the veritable wonderland which *is* modern mathematics.

The nine chapters of *Mathematics and The Imagination* bring forward understandably some of the problems which have interested the Newtons and the Eulers of our day. The paradoxes of the infinite, expressed so annoyingly well by Zeno of Elea a few centuries B. C., and resolved within our time, lead from "Beyond the Googol" to the arithmetic of transfinites. Four dimensional and non-Euclidean geometries, about which much has been written to further becloud a reader's mind, are lucidly treated in the chapter "Assorted Geometries—Plane and Fancy." "Rubber-Sheet Geometry," which seriously presents the mathematical theory of continuous transformations, is amusingly enlivened by its discussions on pretzels and doughnuts, and its suggestion of removing your vest without removing your coat.

"Chance and Chanceability," which discusses the theory of probability, will appeal to that large company whose paramount concern may be in its application to craps, as well as to those interested in determining their chance of escaping death from aerial bombardment. The increditable theorems of Hausdarff and Tarski, showing that the sun may be so divided and then reassembled so as to fit in our vest pocket, are but examples of the interesting subject matter to be found in "Paradox Lost and Paradox Regained." The Pathological Curves of "Change and Changeability—the Calculus" which having an infinite length may still be drawn on a postage stamp, or which can fill a cubical box completely serve to ". . . stand as a magnificent challenge to imagination and as a tribute to mathematical conception."

Mathematics and The Imagination clearly reveals the beauty and romance of modern mathematics. This discipline combines the exactitude of the sciences, the economy of poetry, the counterpoint of music and the significant form and symmetry of art. This is a book which I commend to the attention not only of the layman with intellectual curiosity but also to the professional mathematician.

JOHN DE CICCO.

A NEW TYPE OF ELEVATED TANK

Modernism, or to use a more exact term, functionalism, has been exploited to the utmost in this new elevated tank with a capacity of 100,000 gals. at Longmont, Col. The usual tower, consisting of four or six posts made of structural members, has been replaced by a vertical shaft of welded steel which is supported by a conical base. The storage space is spherical in order to concentrate all the loads at the center. Thus the elements of the structure have been reduced to two, namely a sphere and a pedestal. This tank is elevated 60 ft. above the ground.

The foundation for this type of tank is designed not only for the vertical load but also to withstand any overturning moments. The base of the tank is solidly connected to the foundation by anchor bolts as shown in the picture. Because of this, the tank and its foundation react to wind loads as a unit.

The Chicago Bridge and Iron Company built this tank and several others like it, using butt-welding throughout.

ILLINOIS TECH RELAY GAMES

Illinois Institute of Technology will continue under the auspices of the Illinois Tech Student Association the famous ARMOUR TECH RELAYS GAMES begun by Armour Institute of Technology in the spring of 1928. In the future, the Games will be known as THE ILLINOIS TECH RELAYS, but for the present it is necessary to refer directly to the founder organization so as to adequately tie-in the background and reputation of these famous games.

In the spring of 1941—on Saturday afternoon and evening, March 15—the 13th annual Games will be held. The location again will be the well-known University of Chicago field house, reputed to have the fastest indoor track in the world. The management of the Games will be under the direction of the same committee of veterans, with John Schommer, director of athletics and popular Big Ten official, as chairman. The committee, in all, consists of George S. Allison, treasurer of the Institute, Norman Root, track coach, and Alexander Schreiber, public relations officer.

Recognized as the outstanding track and field meet of the middle west, the 1941 Games will again feature events designed to afford the best of competition to both the university class of athletic teams and those of the college class. One feature will bring together in a matched event selected athletes who are specialists in one particular field.

It is the desire of the committee in charge to create as much interest as possible in the 1941 Games on the part of alumni of both Armour Institute of Technology and Lewis Institute. In previous years, there has been a disappointing lack of alumni representation at the games. While it is recognized that many an alumnus cannot possibly attend because of residence many miles distant from Chicago, it is hoped that the alumni living in Chicago and its suburbs will find it convenient to make early reservations for the 1941 Games.

All alumni will receive from the committee advance information about the Games and the features planned. In addition, machinery will be provided whereby the alumni will be able to make reservations well in advance of March 15, and thus assure themselves of good seats.

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PLACEMENT NEWS

With

A MERRY CHRISTMAS

On June 12, 1941, more than two hundred seniors will receive their Bachelor's Degree, about twenty their Master's Degree, and five will receive the Doctorate. In addition, fifty-eight "Co-ops" will receive their B. S. in Mechanical Engineering this coming January 29. This will be the largest group of students receiving their degrees that ever left the door of "The Tech" at graduation time.

These young lads on graduation should be placed quickly if the national preparedness program keeps up its pace with the demand for engineers. It was not long ago that the doctrine of technocracy filled with alarm many of those engaged in the engineering professions, for fear the market for technically trained men was vastly oversupplied. Now the demand for engineers is unprecedented and this office has had hundreds of jobs it could not fill. An urgent cry has gone out for Mechanical, Electrical, Civil and Metallurgical engineers, in the order given. The greatest demand by far has been for Mechanical Engineers.

A gratifying turn of events has been the demand for engineers from thirty-five to fifty years of age, with experience that would fit them for managerial positions, production engineers, chief engineers, superintendents, plant engineers and executives. Many firms are enticing experienced men away from their jobs in other concerns by the lure of greatly increased wages. In many instances, firms are hiking the wages of their key men to prevent their loss to steel mills, aeroplane manufacturers, and to plants making munitions or accessories needed for the national defense program. The scale of wages appears to be upward and violently upward for many specialized endeavors for several years to come.

The many requests for young engineers are chiefly ones demanding drafting, time and motion, production, wage incentive, and structural and machine design experience. In 1939 I was pleased to obtain a request to send one engineer to a prospective job, and now the requests frequently are for from six to a dozen men. Several of the large aeroplane manufacturers have asked for men skilled in aeroplane design. When I asked, "How many?" their retort was, "We will take hundreds if you have them available."

It is hoped by this department that you alumni are all on the highway of success. If there is anything it can do to aid you, be sure to call on it for service. Help! Help! Help!

I wish to thank those alumni who have responded to the cry, and to remind those who haven't that "Hell is paved with good intentions."

The Department wishes you a Merry Christmas and a Happy New Year full of Happy Hours, Health, Peace and Prosperity.

JOHN J. SCHOMMER,
Director of Placement.

JUNIOR FORMAL

The Junior Formal, major event of the social season of Illinois Institute of Technology, will be held on February 28, 1941, at the Chicago Towers Club, 505 North Michigan Avenue. The orchestra has not been decided upon as yet, but several "name bands" are under consideration. Armour alumni as well as undergraduates are cordially invited to attend and enjoy an evening of fun and frolic. As in previous years, bids will be $5.50 per couple.

The dinner to be served will delight the heart of an Epicurean:

Fruit Cup Florida

Clear Beef Consomme

Celery Hearts   Jumbo Mixed Olives

Filet Mignon with Fresh Mushrooms
Fresh Garden Peas
Stuffed Baked Potatoes

Chef's Salad from the Bowl

Frozen Layer Cake   I. I. T.

Coffee

13TH ANNUAL ILLINOIS TECH RELAY GAMES

Formerly Armour Tech Relay Games

Saturday Evening, March 15, 1941 7:00 P. M.
University of Chicago Field House
56th Street & University Avenue

The Outstanding Indoor
Track and Field Meet of the Midwest.

For Reservations
THE COMMITTEE IN CHARGE
ILLINOIS TECH RELAYS

Illinois Institute of Technology
3300 Federal Street, Chicago

MIDWEST POWER CONFERENCE 1941

The 1941 meeting of the Midwest Power Conference will be held on Wednesday and Thursday, April 9-10, at the Palmer House, Chicago. This Conference is sponsored annually by the Illinois Institute of Technology with the cooperation of seven other midwestern universities and colleges and the local sections of the Founder and other engineering societies. The Conference is entering its fourth year under the present sponsorship.

The purpose of the Midwest Power Conference has been established as that of offering an opportunity for all persons interested in power production, transmission, or consumption to meet together annually for the study of mutual problems, free from the restrictions of required memberships in technical or social organizations. It is felt that academic sponsorship of a conference permits the freest possible discussion ranging from the technical through the economic and into the social aspects of the subject.

The tentative program of the 1941 meeting, as outlined by the directorate of the Conference, includes sessions on Central Station Practice, Stationary Prime Movers and Plant Auxiliaries, Hydro Power, Electric Power Transmission and Distribution, Feedwater Treatment, and Industrial Power Plants. Among the proposed papers for the various sessions are the following: Survey of Stationary Power Facilities from the Standpoint of Defense, A Resumé of Present Day Power Trends, Forced Circulation in American Power Plant Practice, Modern Steam Turbine Design, Variable Speed Drives for Plant Auxiliaries, Hydro Power and the National Emergency, Reestablishment of Cable Communication, Application of Recording Meters and Equipment, Some Problems in Power System Stability, Increasing Power Production with Present Boiler Facilities, and Interchange Contracts between Industrial Plants and Utilities. The tentative program also consists of joint luncheons with the Chicago Sections of the American Society of Mechanical Engineers and American Institute of Electrical Engineers, an All-Engineers' Dinner, an Inspection Trip, and a Smoker.

The Nation's power problems are of vital importance in this day of industrial mobilization and national emergency. The sponsors of the Conference extend to all who are interested in such problems a cordial invitation. The Preliminary Program will be forthcoming in a subsequent issue of the *Armour Engineer and Alumnus*.

Inquiries in regard to the Conference may be addressed to either Stanton E. Winston, Conference Director, or Charles N. Nash, Conference Secretary, in care of the Illinois Institute of Technology, 3300 Federal Street, Chicago, Ill.

FROM YEAR TO YEAR

A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

MAN OF THE MONTH

Nomination for Man of the Month of the Armour Alumni Association goes without question to Clinton E. Stryker, a member of the class of 1917 in the department of electrical engineering. Mr. Stryker recently was made vice-president and assistant to the president of the Nordberg Manufacturing Company of Milwaukee, Wisconsin. He was formerly a partner in McKinsey, Kearney & Company, management consultants in Chicago.

After Stryker was graduated from Armour, he joined the engineering staff of the Commonwealth Edison Company of Chicago as testing engineer. He returned to Armour in 1920, and became successively instructor and assistant professor in the department of electrical engineering. In 1924, the year when he left the Institute, Stryker received from his Alma Mater the professional degree of Electrical Engineer. During this period, he served as chief engineer for the Ozone Pure Arifier Company, and as electrical engineer on the staff of Underwriters' Laboratories.

In 1923, in addition to his many other duties, he did work for the Fansteel Metallurgical Corporation of North Chicago. Gradually severing all other connections, he worked into the Fansteel organization. Here he served successively as electrical engineer, manager of the railway and industrial division, and then as vice-president and general manager of the Ramet Corporation of America, a subsidiary of the Fansteel organization. He finally became chief engineer of all Fansteel's operations.

Stryker's greatest interest always has been in scientific management, especially in organization problems. This interest led him into a partnership in McKinsey, Wellington & Company, which later became McKinsey,

Kearney & Company. His duties included management and engineering service in market investigation, organization and management studies, and financial and general business surveys. He travelled a wide area around Chicago, wherein one of his clients was the Nordberg Manufacturing Company. In his capacity as management consultant, he attracted the attention of the Nordberg Company, and subsequently was selected by the company to carry out one of the recommendations he had made to it.

In alumni affairs, Stryker has been very active. During 1922 and 1923 he served as secretary-treasurer of the Alumni Association. He has been a member of the Advisory Board since shortly after its formation, and of the Board of Managers since 1931. He was nominated in June, 1936, for Alumni Trustee.

Among important contributions to industry made by Stryker is the development and promotion of the use of Balkite rectifiers and battery chargers for railway signal and telegraph service. A member of Eta Kappa Nu and Theta Xi, Stryker also is Fellow of the American Institute of Electrical Engineers, and member of the Society of Automotive Engineers.

THE JACKSON V. PARKER MEMORIAL COLLECTION

Our Department of Fire Protection Engineering, beginning with its establishment in 1903, had particularly friendly relations with Mr. Jackson V. Parker, Manager of the Western Actuarial Bureau. From 1920 until his death in Octobr, 1936, Mr. Parker was Chairman of the Scholarship Committee, through which the capital stock fire insurance companies maintain a system of four-year scholarships in the Department. (The present Chairman of the Committee is Mr. R. M. Beckwith.)

A large number of graduates of the Department, both scholarship and non-scholarship men, have had numerous contacts with Mr. Parker, and he enjoyed the respect and affection of all of them.

Mr. Parker's sister, Miss Frances P. Parker of Newport, Minnesota, has established in our library an endowed collection as a memorial to her brother. The income from the endowment fund is to be used for the purchase of books, pamphlets, reports, charts, periodicals, and other publications relating to insurance and fire protection engineering and to allied subjects. Miss Parker is also providing a book plate, replicas of which will be used to identify books and other publications in the collection, and she is further providing a bronze plate to identify the collection as a whole.

Mr. Parker's friends will recognize that there is no form of memorial which would have pleased him more.

SCHOMMER

Among the best jobs of publicizing Illinois Institute and the virtues of its graduates is that done by John Schommer, formerly President of the Alumni Association, and now Director of the Placement Department. During the past year, John appeared before fifty-two separate groups. He spoke on engineering, athletics, and placement problems, in each case adapting his address to the particular audience.

On several occasions, the immediate audience numbered more than a thousand. At the Alumni Banquet of all colleges at the Morrison Hotel on October 23, 1939, aproximately eleven hundred were in attendance. The dinner of the Public Service Company of Northern Illinois drew more than twelve hundred. In addition to these addresses, Schommer met with Armour Alumni Clubs at Columbus, Detroit, Minneapolis, and New York, and appeared on numerous radio broadcasts. Equally important are the personal interviews by which John has paved the way for many excellent contacts for graduates of Illinois Institute.

MANAGERS' COMMITTEES

Alumni President J. Warren McCaffrey announces the appointment of the following committee chairmen, each of whom is a member of the Board of Managers:

Placement, John J. Schommer; Alumni Relations, Arthur H. Jens; Alumni Awards, William F. Sims; Luncheons, Louis J. Byrne; Constitution, Edward F. Pohlmann; Finance, Claude A. Kneupfer; Banquet, Eugene Voita; Publicity, Richard N. Vandekieft; Fund-Raising, Clinton E. Stryker and Stanley M. Lind.

It is the intention of the Alumni President that the above committees be increased to three or four members by men from the active Alumni Association. If you have a desire to serve on any of the above committees, it is sugested that you write directly to Alumni Secretary W. N. Setterberg at 3300 Federal Street, stating your preference.

1898

Patten, George H., E.E., is with the Chattanooga Medicine Company, St. Elmo Station, Chattanooga, Tennessee. He recently moved to Riverview, Chatanooga, Tennessee.

1907

Boehmer, Alexander Henry, M.E., is a Development Engineer for the Teletype Corp., 1400 Wrightwood Avenue, Chicago, and now resides at 424 Fairview Avenue, Park Ridge, Illinois.

1908

Guerin, James, C.E., is employed at Village Hall, Western Springs, Illinois. His home address is 4538 Lawn Avenue, Western Springs, Illinois.

1909

Youngberg, Harry W., C.E., is now living at 304 Hillside Avenue, Nutley, New Jersey.

1912

Schommer, John J., Ch.E., Professor of Industrial Chemistry, Director of Placement and Director of Physical Education at Illinois Institute of Technology, is now residing at 421 Melrose Avenue, Chicago.

1914

Burnham, Clifford Liston, E.E., who is President of Pal-Verd, Inc., 20 North Wacker Drive, Chicago, is also Colonel, Field Artillery Reserve, Commanding 104th F.A.

1915

Chase, Denton A., C.E., is the owner of the Hardware Plumbing and Heating Co., South Sioux City, Nebraska.

Hibbard, Lewis Edwin, M.E., is employed by Carbonite Metal Company as Sales Engineer, 222 W. North Bank Drive, Chicago. He is now residing at 10718 S. Church Street, Chicago.

1917

Conway, Frank Joseph, F.P.E., is a Piping Engineer for the Carrier Construction Corporation, Merchandise Mart, Chicago. His home is 715 Ashland Avenue, River Forest, Illinois.

Kula, Joseph Stanislaus, F.P.E., is with Marsh and McLennan, 164 W. Jackson Blvd., Chicago. He is now living at 5630 Neva Avenue, Chicago.

1918

Hullinger, Ora Merle, E.E., is Manager of Transformer Sales of the Line Material Company of Zanesville, Ohio. He is residing at 31 Bullitt Park Place, Bexley, Ohio.

1919

Clark, Clarence Benson, Ch.E., employed with the Corn Products Refining Company of Argo, Illinois, has recently moved to 8 Washington Avenue, Downers Grove, Illinois.

1920

Danforth, S. Chester, Arch., is in business for himself at 211 West Wacker Drive, Chicago. He lives at 322 Vine Avenue, Park Ridge, Illinois.

1921

Nedved, Rudolph James, Arch., is an Architect for U. S. Housing Authority, 1613 Riggs Place, N. W., Washington, D. C. He has recently moved to 4319 2nd Road, No., Arlington, Virginia.

Zemke, Arthur William, M.E., is proud to announce the arrival on September 26th, 1940, of an eight pound baby girl at the Zemke household. The family is now living in their own home at 3109 N. 77th Court, Elmwood Park, Illinois.

1922

Davis, Alfred A., Ch.E., is with the Thomas Moulding Floor Company, 165 W. Wacker Drive, Chicago. He has recently moved to 4545 Beacon Street, Chicago.

Goodnow, Edward Anthony, E.E., is employed with the Dearborn Chemical Co., at 310 S. Michigan Avenue, Chicago. He is now living at 7729 N. Hermitage Avenue, Chicago.

1923

Colby, Donald C., E.E., who is a Lubrication Engineer for the Texas Company, 3052 Archer Avenue, has recently moved to 6731 Jeffery Avenue, Chicago. He was admitted to practice law in December, 1939.

Goldstein, Jerome, M.E., is President of the Power Construction Company, 212 S. Marion, Oak Park, Illinois. He has recently moved to 915 Ashland Avenue, Wilmette, Illinois.

Jensen, Roy Paul, M.E., was recently appointed Special Agent for the Fireman's Fund Insurance Cos. for Detroit and Wayne County.

Lucas, Joseph F., M.E., who is Assistant Superintendent of the Special Hazard Department of Hartford Fire Insurance Company, 110 N. Michigan Avenue, Chicago, is now living at 8130 Calumet Avenue, Chicago.

1924

Bennett, Percival A., E.E., is employed with the Public Service Company of Northern Illinois, 159th & Fisk Streets, Harvey, Illinois. He has recently changed his address to 608 3rd Avenue, Joliet, Illinois.

Cooper, Maitland Henry, F.P.E., is in the general insurance and real estate business for himself at 205 Second Avenue, Ottawa, Illinois, and still resides at 327 East Prospect Avenue, Ottawa.

Newman, Alexander L., M.E., is Vice-President of the Precision Scientific Company of Chicago. He is staying at the Graemere Hotel, Chicago.

Richardson, Donald E., E.E., who is Associate Professor of Electrical Engineering at Illinois Institute of Technology, has moved to 8146 Champlain Avenue, Chicago.

Slstak, Edward, F.P.E., is now working for the Missouri Inspection Bureau as Fire Insurance Inspector, 1330 Pierce Bldg., St. Louis, Missouri. His residence is 7000 Stanford, St. Louis, Mo.

Thoelecke, Louis C., F.P.E., who is with the Norwich Union Fire Insurance Society, Ltd., 175 W. Jackson Blvd., Chicago, is now living at 1501 Central Avenue, Chicago.

1925

Chen, Herbert H., E.E., has been working as an engineer for the Hygrade Sylvania Corporation, Loring Avenue, Salem, Mass. He is residing at 37 Lafayette Place, Salem, Mass.

Nedved, Elizabeth Kimball, Arch., who is a Water Colorist and Architect, is now living at 4319 2nd Rd., No., Arlington, Virginia.

1926

Dean, William A., Jr., E.E., who is an Electrical Engineer for the Bowman Dairy Co., 140 W. Ontario St., Chicago, still lives at 316 N. Mayfield Avenue, Chicago.

1927

Brown, Walter L., F.P.E., is Manager of the Union Mutual Life Insurance Company of Portland, Maine, 111 W. Washington Street, Chicago, and is living at 7515 S. Calumet Avenue, Chicago.

Janek, John, M.E., who is an Engineer with Swift & Company, 3337 S. Michigan Avenue, Chicago, is now making his home at 7150 Clyde Avenue.

Mulligan, Charles N., Jr., F.P.E., who is State Agent for the Insurance Company of North America, located at 1525 Carew Tower, Cincinnati, Ohio, resides at 1541 Teakwood Avenue, Cincinnati.

Osgood, Richard G., F.P.E., is now Resident Manager for the Insurance Company of North America, and is in charge of the territory served by its Chicago office.

1928

Bates, Richard Harry, C.E., who is employed by the Standard Oil Company as Division Engineer, is now residing at 507 Cornelia Street, Joliet, Illinois.

Berg, Herbert O., Ch.E., has recently entered into business for himself, and now resides at 8928 Blackstone Avenue, Chicago.

DeBoerge, G. Earl, C.E., who is a Junior Engineer in the Construction Division of the City of Chicago, 79th & Lake Michigan, lives at 2257 N. Keystone Avenue, Chicago.

Eves, John Theodore, F.P.E., was recently transferred to the Cincinnati office of the Firemen's Fund with offices in the Frederick Schmidt Building. His duties will be to assist agents of the Southern Ohio area along production lines.

Henry, Arthur William Jr., F.P.E., has changed his address to 15985 Woodland Drive, Dearborn, Michigan.

Krieger, Harry Leland, F.P.E., is with the Ohio Inspection Bureau, 431 E. Broad St., Columbus, Ohio. He has recently moved to 1755 Wyandotte Place, Columbus, Ohio.

Parker, Kent Hamilton, F.P.E., is Actuary for the Western Actuarial Bureau, Room 900, 222 W. Adams Street, Chicago. He resides at 759 Burr Avenue, Winnetka, Illinois.

Tully, Alan C., C.E., recently returned to the United States from Australia, writes to the Alumni Editor from 120 W. Second Street, Dayton, Ohio:

"By searching your records, you will probably recall that since 1934 I have been located in Melbourne, Australia, where I represented the Ethyl Gasoline Corporation in Australasia and the Far East.

"In May of this year I scrambled back to the good old United States and have rejoined the domestic company (as Assistant Division Manager). It seems very good to get back to this country after all these years and especially so since the European war has so badly distorted all the Outside World.

"My purpose in writing you is mainly to request that you mail my copy of the *Armour Alumnus* to me at the above address. If any of the Armour graduates visit Dayton, I would certainly be glad to see them, especially those of 1928 vintage."

1929

Schildemantel, Herman B., Ch.E., is General Foreman of the Plastics Division of the Brunswick-Balke-Collender Company of Muskegon, Michigan.

Shabino, Clarke L., C.E., is Assistant Factory Accountant for the Brunswick-Balke-Collender Company of Muskegon, Michigan. He is living at 915 Ireland Avenue, Muskegon.

1930

Baldwin, David Carleton, F.P.E., who is a Production Engineer for the Royal-Liverpool Group of Fire Insurance Cos., resides at 2121 North Springfield Avenue, Chicago. He is married and has one daughter.

Bechtold, Joseph A., F.P.E., who is a Fire Survey Engineer for the Travelers Fire Ins. Co., has recently moved to 3298 Milverton Road, Shaker Heights, Ohio.

Berg, Melvin Chester, F.P.E., is an Inspector for the Michigan Inspection Bureau, 1000 Barlum Tower, Detroit, Michigan. He has recently changed his residence to 258 Calvin, Detroit, Mich.

Chen, Edmund H., C.E., Assistant Civil Engineer in the U. S. Engineer's Office at Caddoa, Colo., resides at 307 S. 9th Street, Lamar, Colorado.

McKinnie, William Palmer, M.E., is Project Engineer of the Curtiss Aeroplane Division of Curtiss-Wright Corporation, Kenmore and Vulcan, Buffalo, New York. His residence is 295 Louvaine Drive, Kenmore, New York.

1931

Borrowdale, John Fred, M.E., is now connected with the Army Ordnance Dept., at 309 W. Jackson Blvd., Chicago. After leaving Armour, Fred attended M.I.T., where he received the master's degree. He then joined the consulting engineering firm of Coverdale and Colpitts in New York City. His home address is 7212 Crandon Avenue, Chicago.

Denning, Willard Scott, M.E., is Industrial Engineer for Montgomery Ward and Company in Chicago and is living in LaGrange, Illinois.

James, Frank Marshall, F.P.E., has resigned his position with the Firemen's Group of Fire Insurance Cos. to enter the

local agency business in Lexington, Kentucky.

McArdle, Thomas O'Hare, C.E., is now employed as Industrial Engineer with Lockheed Aircraft Co. of Burbank, California. His residence is 1301 Redondo Boulevard, Los Angeles, California.

1932

Berger, Max, Ch.E., has been teaching for the past two years at Morrill School for Crippled Children, 5923 Magnolia Street, Chicago.

Richter, Harry Paul, C.E., recently spent more than four weeks in the Little Company of Mary Hospital in Evergreen Park, where a major operation was performed. He is in charge of the Real Estate Department in the Middle West for Carnegie-Illinois Steel Corporation, 208 S. La Salle Street, Chicago. His residence is 1539 West 83rd Street, Chicago.

1933

Altschuler, Martin, Arch., has recently changed his address to 2421 Marwin Avenue, Los Angeles, California.

Belford, Robert Ottawa, F.P.E., who is a State Agent for the Pacific National Ins. Co., is now residing at 3303 Park Avenue, Minneapolis, Minnesota.

Berglund, Gunner E., F.P.E., was married on July 27, 1940, to Margaret Olson in Chicago. He is a consultant with the Chicago Board of Underwriters and resides at 3718 Pinegrove Avenue, Chicago.

Bush, Frank L., Arch., was married on October 5th, 1940, to Evelyn L. Dhordt. Their residence is in Lake Forest, Illinois. Bush is employed as a Machine Tool Designer and Engineer for the Illinois Tool Works, 2501 N. Keeler Avenue, Chicago.

Cordes, Emmett L., Ch.E., is Service Engineer for the International Filter Company, 325 W. 25th Place, Chicago. He is traveling extensively in the middlewest in connection with the servicing of water purification plants and sewage disposal plants. His home is at 605 E. 80th Street, Chicago.

Davies, Wilfred W., Arch., is Assistant Superintendent of Engineering Research at United Air Lines Transport Corp., 5959 S. Cicero Avenue, Chicago, and is living at 4147 N. Mozart Avenue, Chicago.

Hanrahan, George E., C.E., has changed his place of residence to 28 Langley Avenue, Highland Park, Portsmouth, Virginia.

Hulswit, William Henry Jr., E.E., who is Physicist, United States Rubber Company, 6600 E. Jefferson, Detroit, Michigan, is married and has a son, Richard, who is eighteen months old. His residence is 5213 Devonshire, Detroit, Michigan.

Meehan, Robert Francis, M.E., is employed by Commonwealth Edison Company as a Boiler Operator. He is living at 6352 S. Francisco Avenue, Chicago.

Nelson, Clifford A., F.P.E., is Special Agent for the Home Insurance Company of New York, 2380 Penobscot Bldg., Detroit, Michigan. He has recently moved to 13220 Cherrylawn Avenue, Detroit, Michigan.

Pihl, Stanley E., M.E., who is a Resident Engineer for the Liberty Mutual Insurance Company, 130 E. Washington Street, Indianapolis, Indiana, lives at 437 E. 38th Street, Indianapolis.

1934

Burson, William W., Ch.E., who is Vice-President and General Manager of Bates Laboratories, Inc., 3512 N. Clark St., resides at 612 Surf Street, Chicago.

Chadwick, Donald N., E.E., has moved to 10924 S. State Street, Chicago.

Koko, Frank William, C.E., is employed as Furnace Practiceman for the Carnegie Illinois Steel Co., 3426 E. 89th Street, Chicago. He is now living at 1722 E. 85th Place, Chicago.

Kolve, Irving Arne, M.E., is now living at 6455 Wabansia Avenue, Chicago.

Shermer, Carl L., C.E., has recently moved to 2114 N. Spaulding Avenue, Chicago.

Tamney, J. Edward, E.E., is now making his home at 851 N. Ridgeway, Chicago.

1935

Bisble, Hugh A., E.E., is a Motor Inspector for the Youngstown Sheet & Tube Company, Indiana Harbor, Indiana. He has recently changed his residence to 7714 Forest Avenue, Hammond, Indiana.

Jones, Thomas Franc., M.E., has recently moved to 114 Barclay Avenue, Flushing, Long Island.

Petraitis, Albert, E.E., is working for his Master's Degree at California Institute of Technology, Pasadena, California.

Schmidt, Edward Walter, Ch.E., is with the Link Belt Company, 18th and Western Avenue, Chicago, and is now making his residence at 6816 Perry Avenue, Chicago.

Slavitt, Harold H., Arch., is Illuminating Engineer and Lecturer for the Chicago Lighting Institute, Room 3600, 20 N. Wacker Drive, Chicago. He has recently moved to 208 S. Kostner Avenue, Chicago.

Tiensson, Arvid, Ch.E., is a Mechanic for the Drying Systems, Inc., at 1800 Foster Street, Chicago, and is living at 6131 N. Wolcott Avenue, Chicago.

1936

Bagnuolo, Joseph W., Arch., was married on September 14, 1940. He and his bride drove to the west coast on their honeymoon. He is an Architectural Designer for the Department of Public Works in Chicago, and resides at 5840 W. Fillmore Street, Chicago.

Boerg, Charles P., E.E., is with Belt, Wallace & Cannon, Patent Attorneys, 1 N. La Salle Street, Chicago. He was married on June 29th, 1940, and is living at 7215 Vincennes Avenue, Chicago.

Bothwell, Robert H., E.E., is in his third year at the Northern Baptist Theological Seminary in Chicago. He expects to receive his B.D. degree in May, 1941. His home residence is 2057 Summerdale Avenue, Chicago.

Davis, John B., F.P.E., who is an Engineer for the Insurance Co. of North America, located at 209 W. Jackson Boulevard, Chicago, is living at 916 Linden Avenue, Winnetka, Illinois.

Dollenmaier, Harry Raymond, E.E., is now connected with the Chicago Rawhide and Leather Co., 1301 N. Elston Avenue, Chicago, as a Sales Engineer. He has recently moved to 133 Lincoln Avenue, Libertyville, Illinois.

Knaus, Rodger Gottfrid, E.E., is employed by the General Electric Company of Schenectady, New York, and has recently moved to 18 Troy Place, Schenectady, N. Y.

Landes, John Edward, C.E., is a Civil Engineer with Charles De Leuw Company, 20 N. Wacker Drive, Chicago. He is now living at 8135 Ellis Avenue, Chicago.

1937

Carroll, Kenneth Frederic, M.E., has changed his address to 23 Knowlton Avenue, Kenmore, New York.

Ciechanowicz, Eugene Gregory, C.E., is a Draftsman with the Charles DeLeuw & Company, 20 N. Wacker Drive, Chicago. He has recently moved to 1817 S. Winchester Avenue, Chicago.

Devereaux, Raymond J., Eng. Sc., is an Industrial Arts Teacher, Chicago Board of Education, 1820 W. Yeaton Street. His home address is 7727 South Shore Drive, Chicago.

Fleissner, Anton George, M.E., is employed as Junior Designing Engineer for the Hydraulic Controls, Inc., at 111 W. Monroe Street, Chicago. His home is at 1941 Washington Boulevard, Chicago.

McCarty, Carroll J., C.E., who has been a Junior Engineer in the Illinois Highway Dept., has been awarded a Fellowship in the Bureau for Street Traffic Research in Yale University for the present academic year.

Shukes, Charles Joseph, Ch.E., F.P.E., '40, is now with the Kentucky Actuarial Bureau, Starks Bldg., Louisville, Ky. His Chicago address is 4659 Jackson Boulevard.

1938

Andrews, Fred Woodrow, C.E., is now in partnership with his father, a General Contractor located at 5660 N. Kedzie Avenue, Chicago. He is still residing at 2314 Morse Avenue, Chicago.

Bodnar, Henry John, Ch.E., who is now in business for himself at 11923 South Halsted Street, Chicago, still resides at 710 W. 118th Street, Chicago.

Gilkison, Thomas Mortimer, Ch.E., has moved to 802 Amarillo, Abilene, Texas.

Hanneman, Frank T., M.E., is Mechanical Engineer for the Paasche Airbrush Company at 1909 W. Diversey Avenue, Chicago. His home is at 1121 Sherwin Avenue, Chicago.

Sheehan, James D., F.P.E., is Fire Insurance Inspector for the Kansas Inspection Bureau, 701 Jackson Street, Topeka, Kansas. He resides at 334 Van Buren, Topeka, Kansas.

1939

Bughi, Joseph P., C.E., has moved to 1703 N. Mozart Street, Chicago.

Carlson, Ernest C., C.E., is employed as Draftsman for the Page Engineering Company located in Clearing, Illinois. He is living at 1124 N. Leamington, Chicago.

Chadderton, Julian Cuthbert, C.E., is employed by Herlihy Mid-Continent Company, 140 S. Dearborn, as an Estimator. His home address is 1702 North Winchester, Chicago.

Evanoff, Stephen, Jr., Ch.E., is now with the DuPont De Nemours Co., 2100 Elston Avenue, Chicago, as a Chemist and Chemical Engineer. He is residing at 2519 S. Spaulding Avenue, Chicago.

Felt, Winchester G., E.E., is now a Laboratory Assistant for Rock-Ola Mfg. Co., 800 N. Kedzie Avenue, Chicago. His home address is 1226 W. Jackson Boulevard, Chicago.

Zarem, A., E.E., is teaching assistant in Electrical Engineering at California Institute of Technology, 1201 E. California Street, Pasadena, California.

1940

The following census gives a complete listing of the graduating class of 1940, the companies by which these men are employed, together with their home addresses and home telephone numbers. Members of the class are urged to advise the Alumni Office as soon as changes in position or home address are made. Personal information for use in future issues of the *Engineer - Alumnus* should be addressed to the Alumni Editor.

Abrahamson, Robert, M.E., Sunbeam Heating and Air Conditioning Company, 1717 South Canal Street, Chicago, Canal 4024. Home: 1624 Farwell Avenue, Chicago, SHE 6892.

Alter, Frank Julian, F.P.E., Missouri Inspection Bureau, Pierce Bldg., St. Louis, Missouri. For mail: 1700 Washington Avenue, Wilmette, Illinois.

Anderson, Floyd Edgar, E.E., Carnegie-Illinois Steel Company, 3426 E. 89th Street, Chicago, South Chicago 4000. Home: 1414 North Austin Boulevard, Oak Park.

Avgerenos, Harry G., Ch.E. Home: 5048 West Quincy Street, Chicago.

Balis, Moorman Randall, M.E., Bendix Aviation Corporation, Aircraft Engineering Division, South Bend, Indiana. For mail: 1000 Grove Street, Evanston, Illinois.

Balsewick, John Charles, C.E., State Highway Dept., Division of Public Works and Highways, 35 East Wacker Drive, Chicago. Home: 718 West 31st Street, Chicago.

Bartusek, Robert James, M.E., Armour Research Foundation, 3300 Federal Street, Chicago. Home: 2537 South Drake Avenue, Chicago.

Basic, Ernest, E.E., Russell Electric Company, 340 West Huron Street, Chicago, SUP 9740. Home: 2417 South 61st Court, Cicero, Illinois, Cicero 2510 R.

Benz, Joseph James, E.E., Carnegie-Illinois Steel Company, 3426 E. 89th Street, Chicago, Illinois, South Chicago 4000. Home: 7822 Essex Avenue, Chicago.

Bigos, Casimir Lucien, Ch.E., Bastian Blessing, 240 E. Ontario Street, Chicago, SUP 7060. Home: 5123 Medill Avenue, Chicago.

Blume, Leroy Orison, M.E., Armour and Company, U. S. Yards, Chicago. Home: 6513 Northwest Highway, Chicago.

Bouland, Charles Victor, Arch., Draftsman, Designer, A. T. McIntosh, 160 North LaSalle Street, Chicago, FRA 2040. Home: 1911 Bernice Avenue, Chicago, Lakeview 1225.

Brannick, Edward Joseph, F.P.E., Fire Insurance Rating Bureau, 626 E. Wisconsin Avenue, Milwaukee, Wisconsin. For mail: 6357 South Washtenaw Avenue, Chicago.

Byrne, Charles Joseph, Jr., E.E., Illinois Pneumatic Tool Company, Aurora, Illinois. For mail: 5114 South Christiana, Chicago.

Caldwell, William Malcolm, Eng. Sc., Carnegie-Illinois Steel Company (Metallurgy), 3426 E. 89th Street, Chicago, South Chicago 4000. Home: 14744 Main Street, Harvey, Illinois, Harvey 614.

Camras, Marvin, E.E., Graduate Assistant, Armour Research Foundation, 3300 Federal Street, Chicago. Home: 1061 North Western Avenue, Chicago.

Cannon, Russell, M.E., Babcock and Wilcox Company, Barberton, Ohio. For mail: 9710 South Damen Avenue, Chicago.

Catlin, John, M.E., Du Pont Company, Wilmington, Delaware. For mail: 7611 Paxton Avenue, Chicago.

Cerovski, John George, Arch., John Phrommer, 927 First Trust Bldg., Hammond, Indiana. Home: 233 West 104th Place, Chicago.

Charlton, James Donald, Ch.E., Purdue University (Fellowship), Lafayette, Indiana. Home: 234 Littleton, West Lafayette, Indiana.

Clark, Jack Andrew, M.E., International Filter Company, 325 W. 25th Place, Chicago. Home: 5054 Berwyn Avenue, Chicago.

Cohen, Jacob Irving, E.E., Belson Manufacturing Company, 800 S. Ada Street, Chicago, HAY 8464. Home: 1254 South Avers Avenue, Chicago.

Collins, Walter Scott, M.E., G. S. Blakleslee & Company, 1844 52nd Avenue, Cicero, Illinois. Home: 5636 North Moody Avenue, Chicago, PAL 9482.

Collopy, Robert John, Ch.E. Home: 212 North Kenneth Avenue, Chicago.

Constan, Peter Louis, M.E. Home: 4715 North Troy Street, Chicago.

Dahl, Walter Leroy, F.P.E., Iowa Insurance Service Bureau, Insurance Exchange Bldg., Des Moines, Iowa. For mail: 7317 Rhodes Avenue, Chicago.

Dahlin, Harold John, M.E., Carnegie-Illinois Steel Company (Maintenance Dept.), 3426 East 89th Street, Chicago, South Chicago 4000. Home: 6709 North Washtenaw Avenue, Chicago.

Damm, Griffith Elmer, E.E., Chicago Board of Underwriters, 175 West Jackson Blvd., Chicago, WAB 4151. Home: 6119 Grace Street, Chicago.

Danforth, George Edward, Arch., Illinois Institute of Technology (Graduate Student in School of Architecture), 3300 Federal Street, Chicago. Home: 58 East Elm Street, Chicago, DEL 7417.

Dement, Clayton Warren, F.P.E., Illinois Inspection Bureau, 309 West Jackson Blvd., Chicago. Home: 6634 South Michigan Avenue, Chicago.

Dickerhoof, Oliver Newton, M.E., Danly Machine Specialties, 2104 South 52nd Avenue, Cicero, Illinois, LAW 7440. Home: 7842 South Michigan Avenue, Chicago, VIN 9457.

Doolittle, Harold A., Ch.E., Rand, McNally & Company, 536 South Clark Street, Chicago, WAB 0363. Home: 5812 South Fulton Street, Chicago, COL 6499.

Duncan, James Winston, Ch.E., Inland Steel Company, 38 South Clark Street, Chicago. Home: 8040 Oglesby Avenue, Chicago, REG 5076.

Dzikowski, Irvin John, Ch.E., American Maize Products Company, Chicago. Home: 3100 West Diversey Avenue, Chicago.

Eggers, John George, F.P.E., Kentucky Actuarial Bureau, 940 Starks Bldg., Louisville, Kentucky. Home: 118 West Ormsby Street, Louisville, Kentucky.

Elgenson, Leonard, C.E., Illinois State Highway Department, Springfield, Illinois. For mail: 1106 Glenlake Street, Chicago.

Ellis, Frederick L., E.E., Miehle Printing and Mfg. Company (Training Division, West 14th Street & South Damen, Chicago). Home: 3154 West 16th Street, Chicago, CRA 7725.

Epstein, Leon Simpson, M.E., Ilg Ventilating Company, 2850 North Pulaski Road, Chicago, KIL 1520. Home: 238 North Pine Avenue, Chicago, AUS 3690.

Erisman, Ralph James, M.E., Armour Research Foundation, 3300 Federal Street, Chicago. Home: 632 Lyman Avenue, Oak Park, Illinois.

Eulo, Charles Robert, M.E., Glenn L. Martin Company, Baltimore, Maryland. For mail: 2924 Greenleaf Avenue, Chicago.

Fahey, James Martin, Ch.E., University of Chicago, (Fellowship) Institute of Meteorology, Chicago. Home: 6230 Vernon Avenue, Chicago.

Faulkner, Alfred Hughes, E.E., Automatic Electric Company, 1019 West Van Buren, Chicago, HAY 4300. Home: 752 North Central Avenue, Chicago, AUS 270.

Fiebig, John Clarence, C.E., Illinois State Highway Dept., Springfield, Illinois. For mail: 18464 Martin Street, Homewood, Illinois.

Firant, Edgar Robert, Arch., A. F. Heino, Architect, Morgan Park, Illinois. Home: 630 West 61st Street, Chicago

Flood, James Gregory, Ch.E., Walter H. Flood & Company, 822 E. 42nd Chicago, ATL 0011. Home: 932 East 44th Street, Chicago.

Forsberg, Carl Otto, Ch.E. Home: 1030 Hull Terrace, Evanston, Illinois.

Foss, Paul Howard, Ch.E., Carnegie-Illinois Steel Company, 3426 E. 89th Street, Chicago, South Chicago 4000. Home: 4929 Montana Street, Chicago.

Foster Earl Eugene, Ch.E., Armour & Company, U. S. Yards, Chicago. Home: 7863 Gottschalk Avenue, Homewood, Illinois.

Foster, Robert James, Ch.E. Home: Sibley Boulevard, Dolton, Illinois.

Fox, John Jay, Jr., Arch., Chicago Board of Education. Home: 9250 South Damen Avenue, Chicago.

Franconе, Edmund Arnold, M.E., Illinois Tool Works, 2501 North Keeler, Chicago. Home: 6934 South Hermitage Avenue, Chicago, REP 6047.

Frost, George Edward, E.E., Delta Star Electrical Company, 2437 W. Fulton Street, Chicago, SEE 3200. Home: 726 North Kenilworth Avenue, Oak Park, Illinois.

Gaebler, George Frederick, M.E., Glenn L. Martin Company, Baltimore, Maryland. For mail: 8537 South Bishop Street, Chicago.

Galandak, August, M.E., R. S. Rainey, 750 West Roosevelt Road, Chicago, AUS 180. Home: 2801 South St. Louis Avenue, Chicago.

Gentlemen, William James, Jr., M.E., Danly Machine Specialties, 2104 South 52nd Avenue, Cicero, Illinois. Home: 7918 Langley Avenue, Chicago.

Gerhardt, John Randolph, Eng. Sc., Armour & Company, Industrial Engineering Dept., U. S. Yards. Home: 547 North Taylor Avenue, Oak Park, Illinois.

Goluszka, Walter Edward, Jr., C.E., Illinois State Highway Dept., Spring Valley, Illinois. For mail: 2001 West Cullerton, Street, Chicago.

Gromack, Theodore, M.E., U. S. Government, Rock Island Arsenal, Rock Island, Illinois. For mail: 10317 South Union Avenue, Chicago.

Gruca, Edward Peter, Ch.E., Inland Rubber Company, 146 West 27th Street, Chicago, VIC 8144. Home: 4200 North McVicker Street, Chicago, PEN 8632.

Grunwald, Robert Fred, E.E., Illinois Bell Telephone Company, 212 West Washington Street, Chicago, OFF 9300. Home: 04 Marion Street, Oak Park, Illinois.

Hanna, George Parker, Jr., C.E., New York University, College of Engineering (Fellowship), University Heights, New York City. For mail: 6409 Drexel Avenue, Chicago.

Hansen, Arthur Grant, Jr., M.E., Chicago Board of Underwriters, 175 West Jackson, Chicago. Home: 1526 Devon Avenue, Chicago, SHE 9381.

Hartman, John Woodrow, E.E., Glenn Martin Company, Baltimore, Maryland. For mail: 7502 Kingston Avenue, Chicago.

Hassell, Vernon James, F.P.E., Western Factory Insurance Association, Detroit, Michigan. Home: 4052 Kendall Avenue, Detroit, Michigan.

Haubert, William Andrew, Ch.E., DuPont Company, Toledo, Ohio. For mail: 405 South Clifton Avenue, Park Ridge, Illinois.

Heenan, Sidney Allan, Ch.E., Van Schaack Chemical Works, Inc., 3430 Henderson Street, Chicago, IND 0400. Home: 2158 Jackson Boulevard, Chicago.

Heller, Joseph T., E.E., Service Industries, 2025 Calumet Avenue, Chicago, VIC 6040. Home: 4330 Greenwood Avenue, Chicago.

Herdman, Donald Floyd, E.E., Commonwealth Edison Company, 72 West Adams Street, Chicago. Home: 7538 Michigan Avenue, Chicago.

Himelmayr, Fred Arthur, E.E. Home: Rushville, Indiana.

Holle, Frederick D., M.E., Western-Austin Company, 601 N. Farnsworth, Aurora, Illinois, A. 8753. Home: 10828 Prospect Avenue, Chicago, BEV 4699.

Horn, Edward Henry, E.E., Carnegie-Illinois Steel Company, 3426 E. 89th Street, Chicago, South Chicago 4000. Home: 825 West Armitage Avenue, Chicago.

Horton, William David, Arch., Store Modernizing Service, 1655 Milwaukee Avenue, Chicago. Home: 14 East Pearson Street, Chicago.

Hunter, Thomas Alexander III, F.P.E., Western Factory Insurance Association, Chicago. Home: 4642 Malden Street, Chicago.

Hutton, William Carl, Arch., William S. Hutton, 122 South Michigan Avenue, Chicago. Home: 25 Wildwood Road, Hammond, Indiana.

Jacobs, Louis, Arch. Home: 3450 Irving Park Road, Chicago.

Jaedtke, Gilbert Harry, C.E., Illinois State Highway Dept., Springfield, Illinois. For mail: 13411 Greenwood Avenue, Blue Island, Illinois, B. I. 2279.

Jakubowski, Alexander Anthony, Arch. Home: 4505 West Deming Place, Chicago.

Johnsson, Peter, Jr., E.E., Underwriters' Laboratories, 209 E. Ohio Street, Chicago. Home: 3425 Douglas Boulevard, Chicago.

Kahl, Walter Harry, Ch.E., Armour & Company, Industrial Engineering Division, U. S. Yards. Home: 8947 South Paulina Street, Chicago, BEV 7761.

Kalnin, Eugene Jack, Ch.E., Chicago Pipeline Company, Gas Measurement Dept., 122 South Michigan Avenue, Chicago. Home: 4936 Parker Avenue, Chicago.

Kazmierowicz, Constantine Andrew, Ch.E., Chicago Extruded Metals Company, 1642 South 54th Avenue, Cicero, Illinois, CRA 2124. Home: 1657 West 47th Street, Chicago.

KLAMKA, STANLEY GEORGE, M.E., Carboloy Company, Inc., 565 West Washington Street, Chicago, CEN 0633. Home: 2201 North Long Avenue, Chicago, BER 0040.

KOHN, ROBERT S., M.E., U. S. Government, War Dept., Ordnance Division, Washington, D. C. For mail: 7704 Essex Avenue, Chicago.

KREYDICH, WALTER, E.E., Switchboard and Supply Company, 6650 South Cicero Avenue, Cicero, Illinois, POR 6900. Home: 1527 South Marshfield Avenue, Chicago.

LASKER, FRANK ALLEN, M.E., Lasker Boiler & Engineering Corporation, 3201 South Wolcott, Chicago, LAF 3700. Home: 3411 South Western Avenue, Chicago.

LEASE, BEN GRIFFITH, M.E., Harper-Wyman Mfg. Company, 8562 Vincennes Avenue, Chicago, RAD 7788. Home: 10214 South Wood Street, Chicago, CED 0163.

LEONARD, FRANCIS MICHAEL, E.E., Carnegie-Illinois Steel Company. Home: 7740 Vernon Avenue, Chicago.

LEONHARDI, JULIAN ODEL, E.E., The Hallicrafters, Inc., 2611 South Indiana Avenue, Chicago, CAL 1690. Home: 18416 Martin Avenue, Homewood, Illinois.

LINDGREN, LEROY HARRY, M.E. Home: 1940 North Kedzie Avenue, Chicago.

LUBER, MORTON EUGENE, F.P.E., Indiana Inspection Bureau, Merchants National Bank Bldg., Terre Haute, Indiana. For mail: 1020 West Monroe Street, Chicago.

LUNDQUIST, LESTER EMANUAL, E.E., Electro-Motive Corp., LaGrange, Illinois. Home: 7612 South Morgan Street, Chicago.

MACKEY, DONALD JAMES, C.E., Glenn L. Martin, Baltimore, Maryland. For mail: 6951 S. Winchester Avenue, Chicago, REP 1042.

MACKEY, WILLIAM EDWARD, C.E., St. Rita High School (Instructor), 6312 S. Oakley Street, Chicago. Home: 6951 S. Winchester Avenue, Chicago, REP 1042.

MANDEL, ERNEST MARVIN, Arch., Ralph Harris (State Architects Office), Springfield, Illinois. For mail: 652 Gordon Terrace, Chicago.

MASHINTER, WILLIAM HECTOR, M.E., Standard Oil of Indiana, Whiting, Indiana. Home: 5051 North Damen Avenue, Chicago, ARD 0311.

MASIN, JOHN LUTON, Ch.E. Home: 6958 Riverside Drive, Berwyn, Illinois.

MAXWELL, ROBERT BLANE, JR., F.P.E., Missouri Inspection Bureau, Pierce Bldg., St. Louis, Mo. Home: 1528 Locust St., St. Louis, Mo.

McDANIEL, HARDEY IRVING, Ch.E., Carnegie-Illinois Steel Company, 3426 E. 89th street, Chicago, South Chicago 4000. Home: 635 S. Elmwood Avenue, Oak Park, Illinois, EUC 3723R.

McDERMOTT, JAMES EUGENE, M.E., Whiting Corporation, 157th and Lathrop, Harvey, Illinois, INT 9615. Home: 2636 N. Francisco Avenue, Chicago.

MENTZEL, SIGMUND THEODORE, E.E., Carnegie-Illinois Steel Company, Gary, Indiana. Home: 4819 N. Melvina Avenue, Chicago.

MEYER, JAMES RAYMOND, Ch.E., Linde Air Products, Buffalo, New York. Home: 48 Linwood Avenue, Buffalo, New York.

MICHKA, STEVE MAX, E.E. Home: 1249 South Kedzie Avenue, Chicago.

MILLER, FRANK, Ch.E. Home: 1701 Halsted Street, Chicago.

MINARD, GEORGE WELLINGTON, Ch.E., Chicago Extruded Metals Company, 1612 S. 54th Avenue, Cicero, Illinois, CIS 1544. Home: 2736 N. Mildred Street, Chicago, BIT 6520.

MIROTSNIC, JULIUS GEORGE, Arch. Home: 6938 Dorchester Avenue, Chicago.

CLASSIFIED ADVERTISEMENTS

MOULDER, WILLIAM KENNETH, E.E., Public Service Company of Northern Illinois, 72 West Adams Street, Chicago, RAN 2500. Home: 114 South Harvey Avenue, Oak Park, Illinois.

MUELLER, RAYMOND ALBERT, M.E., Crane Company, 836 S. Michigan Avenue, Chicago, WAB 3135. Home: 6110 S. Talman Avenue, Chicago.

NADER, FRANK ALBERT, JR., E.E., Illinois Institute of. Technology, Research Foundation, 3300 Federal St., Chicago. Home: 1424 Farragut Street, Chicago, ARD 3997.

NATINCHIK, NICHOLAS ALEXANDER, Ch.E., Socony-Vacuum Company, 123 North Wacker Drive, Chicago, STA 5977. Home: 3407 N. Springfield Avenue, Chicago, JUN 6753.

NEWKIRK, JAMES ALEXANDER, C.E. Home: 1101 South Richard Street, Joliet, Illinois.

NEWMAN, HENRY FREDERICK, Ch.E., Graduate Student, Illinois Institute of Technology, 3300 Federal Street, Chicago. Home: 712 Cornelia Avenue, Chicago, BIT 4769.

OLDENBURG, KENNETH FREDERICK, E.E., International Business Machines Corp., 233 W. Madison Street, Chicago, DEA 8260. Home: 6153 South Talman Avenue, Chicago, REP 6878.

Olufsen, George, C.E., Glenn L. Martin Company, Baltimore, Maryland. For mail: 8150 South Laflin Street, Chicago.

O'Neill, Rea Arthur, C.E., Illinois State Highway Dept., Springfield, Illinois. For mail: 2850 North Lindor Street, Chicago.

Opila, Francis Anthony, C.E., Illinois State Highway Dept., Springfield, Illinois. For mail: 2917 West Cermak Road, Chicago.

Otrembiak, John Joseph, M.E., Pullman Standard Car Mfg. Co., 110th & S. Cottage Grove Avenue, Chicago. PUl. 1400. Home: 11201 Normal Avenue, Chicago.

Pasiuk, Theodore, Arch., Welson Construction Company, 2233 West Grand Avenue, Chicago. Home: 1019 North Wood Street, Chicago.

Patlogan, Louis, Ch.E. Home: 3010 Wabansia Avenue, Chicago.

Pedersen, Arthur Hall, C.E., Glenn L. Martin Company, Baltimore, Maryland. For mail: 407 Lenox Avenue, Oak Park, Illinois.

Petri, Ralph, Ch.E., Farley Mfg. Company, 2650 W. Belden, Chicago, ARM 3820. Home: 2033 N. Keystone Avenue, Chicago.

Pierson, Carl Dan, E.E., Illinois Bell Telephone Company, 212 W. Washington Street, Chicago, OFF 9300. Home: 1717 Summerdale Avenue, Chicago.

Prather, Fred Henry, Arch. Home: 559 Surf Street, Chicago.

Preihler, Norbert Jacob, Ch.E., Miehle Printing Press Mfg. Co., West 14th and South Damen Avenue, Chicago. Home: 1633 N. Damen Avenue, Chicago.

Puhl, Richard Joseph, Ch.E., Claud S. Gordon Company, 1524 S. Western Avenue, Chicago, HAY 4983. Home: 1025 North East Avenue, Oak Park, Illinois, ARD 6694.

Quandee, Harry Bernhard, F.P.E., Western Factory Insurance Association, 75 W. Jackson Blvd., Chicago. Home: 5742 Loomis Street, Chicago.

Ransel, James Paul, F.P.E., Indiana Inspection Bureau, 320 N. Meridian Street, Indianapolis, Indiana. For mail: 773 Tyler Street, Gary, Indiana.

Rehwaldt, Robert Arthur, E.E., Sargent and Lundy, 140 S. Dearborn, Chicago, FRA 7130. Home: 201 South Cuyler Avenue, Oak Park, Illinois.

Rentscher, Roland Roy, M.E., Danly Machine Specialties, 2104 S. 52nd Avenue, Cicero, Illinois, LAW 7440. Home: 5745 Wilson Avenue, Chicago.

Ressler, Harold William, M.E., Powers Regulator Company, 2720 N. Greenview Avenue, Chicago, BUC 7100. Home: 206 North Ashland Avenue, Chicago.

Reyns, Paul Raphael, E.E., Youngstown Sheet and Tube Co., 111 West Washington Street, Chicago, FRA 5170. Home: 016 South Park Avenue, Chicago, WEN 136.

Risany, Joseph John, M.E., Carnegie-Illinois Steel Company, 3426 E. 89th Street, Chicago, South Chicago 1000. Home: 2042 West 51st Street, Chicago. PRO 2792.

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INDUSTRIAL HEALTH

(From page 20)

kinds of fields: safety engineering, industrial hygiene engineering, and preventive medicine in industry. In the practical working out of these problems, the plant engineer can be of particular value because of the fact that he is a technical man. He understands the various processes of manufacturing in different groups, and therefore is in a position to be able to know exactly what is taking place in the various operations.

However, adequate understanding of the significance of such industrial operations with respect to the health of employees, demands additional kinds of knowledge, such as that involved in safety engineering and industrial hygiene engineering. It seems important that various engineering courses include the fundamentals and the ground-work with reference to modern practices in safety engineering and industrial hygiene engineering. Such courses should be supplemented by actual inspections and by different types of surveys, both in organizations where good programs have previously been in effect and also in establishments where there have been no applications of health control programs.

All technical schools and professional schools of various types of courses have crowded curricula, and it is almost impossible to get administrative officers of any organization to see the necessity for including additional material. The author has already encountered this difficulty in medical schools, nursing schools, and in regular university work.

There is no question that the usefulness of the plant engineer could be increased in a practical way if it were possible to at least expose him to the fundamentals of safety and industrial hygiene. The plant engineer would certainly be in a position to cooperate with other persons in the health control program, particularly with the management, the physician, nurse, and consultants who from time to time visit his plant, because of unusual problems.

As an aid to any engineer who may be interested, the author has devised a check-list from which can be made a record of materials and supplies, processes and operations, and the methods and conditions under which work is performed. This check-list will serve as a starting point in the study of potential, actual or legal health hazards. The interested reader may secure a copy through the *Armour Engineer and Alumnus.*

WITH FM

(From page 24)

a vector which corresponds to the frequency of the carrier and can therefore be added to the signal current.

The vector which represents a frequency modulated carrier would have a constant length but a varying angular velocity. A varying angular velocity can be thought of as a vector which is changing its phase with respect to one which revolves at a constant rate. That is, when the velocity of our vector is increasing, we have a condition which could be thought of as a phase advancement. If this phase swing amounts to several thousand degrees, it is evident that the addition of a random noise vector will produce only negligible phase shift as compared to the modulation of the transmitter. This means that interference and noise have only a minor effect in transmission over a wide band frequency-modulated system.

The receiver for this type of carrier must be responsive to a frequency change, rather than to a change in amplitude. To suppress noise and to reduce interference, the signal is first amplified and then is impressed upon a "limiter tube" which holds the amplitude of the signal to an essentially constant level. The constant amplitude signal is impressed on a device which has an output proportional to the carrier frequency. The device is called a "discriminator," and combines the properties of a frequency sensitive circuit and a detector. Since this circuit functions over a wide frequency range, the high as well as low frequencies are easily handled by the receiver without distortion. In other words, the fidelity or quality of speech or music over the frequency-modulated system is not handicapped by the loss of any useful part of the sound energy.

It is easy to produce frequency modulation by a simple device which might be illustrated by a condenser microphone in the tuned circuit of a self excited oscillator. In this type of microphone, the capacitance changes proportionally to the sound pressure impinging on the diaphragm. Therefore the frequency of the oscillator will be an inverse function of the pressure and over a limited range in an essentially linear manner. This simple device cannot be employed by broadcasting stations for the reason that radio stations are required to hold the frequency of their carriers within very close limits. In order to maintain this close frequency control, a piezo-electric crystal is used. This apparent anomaly introduces one of the major difficulties of a frequency modulated system. The problem is to maintain the carrier at an exact frequency by means of a crystal and then to vary its frequency according to the audio-signal. Major Armstrong solved this problem by producing a phase shift at a low radio frequency; then by a series of frequency multipliers which multiply not only the frequency but the phase angle, the necessary frequency swing is produced. By multiplying the frequency two or three thousand times the phase angle change correspond to a frequency swing up to fifty or seventy five thousand cycles per second. The large number of stages necessary for this multiplication results in a rather complicated transmitter. However, the multiplication

is accomplished in low power stages, so that total cost is not great.

More recently, a simplification of frequency modulating has been developed. The frequency of a self-excited oscillator is controlled by a reactance tube which corresponds to the condenser microphone mentioned previously. Then, to prevent the average frequency of the carrier from drifting too far from its assigned channel, a crystal-controlled oscillator constantly monitors and stands by to automatically bring the carrier back to its proper value.

Frequency modulation receivers are not inherently more expensive than receivers for amplitude modulation. However, in order to take advantage of the increased fidelity possible with frequency modulation, the acoustic properties of the receiver must be better than average.

An extension of audio-frequency response into the higher frequency range must be accompanied by an increase in the low frequency response if balance is to be maintained. It is a psychological fact that for reproduced music or speech to have a pleasant sound, the high and low frequencies must be present in proper porportion. Small table models that reproduce the high audio-frequencies efficiently will not be satisfactory because the low frequencies will be lacking. In order to reproduce the low frequencies, a reasonably large cabinet with proper acoustical treatment is necessary. Aside from being a piece of furniture, a radio receiver is also a musical instrument and the skill of its maker is reflected in its performance.

At present there are several FM stations in New York and New England, one in Chicago, and others in widely separated parts of the country. The local experimental frequency-modulated FM transmitter, W9XZR, operated by the Zenith Radio Corporation and located in the Chicago Towers, has been in operation for about one year. This station operates on a full-time schedule and provides an almost continuous musical program, largely from high quality transcriptions. In addition to Zenith, a number of local companies have applied to the Federal Communications Commission for licenses to operate commercial FM stations. Indications are that these applications will be acted on shortly, and prospects are fairly good that we shall have four or five FM stations in Chicago early in 1941.

SOURCES OF ENERGY

(From page 17)

No large tidal power plants have ever been constructed, but a small one developing three hundred horsepower has been operated successfully in England. A one million, two-hundred-thousand-horsepower plant was proposed for the mouth of the Severn river and claims were made that power could be generated at 1.7 mills per kilowatt hour. The head on the turbines was expected to vary from thirty-two feet to five feet and the power variation was to be smoothed by pumping to a high-level reservoir. The eventual development at Passamaquoddy Bay contemplated two storage basins to be constructed by damming the entrances to two bays. One of these basins would be maintained near high-tide level and the other near low-tide level, and in this way a practically constant difference would be available. It has been estimated that one million horsepower can be developed at this site. The plans called for initial construction of only one basin, to be maintained near low-tide level; this involved the use of a variable head. As everyone knows who reads the papers, this project was never completed and one hears nothing about it at the present time.

Hydro-electric Power. Falling water furnishes a very desirable source of power because by the action of sun and wind the water is being continually returned to its high level. Thus we are not consuming our principal, as in the case of using fuels, but are merely using the interest on deposits in the bank, to use a simple analogy. The chief difficulty in developing power from this source is the wide seasonal variation in flow which necessitates large expenditures for dams and reservoirs. Although there is still considerable potential water power at undeveloped sites, most of these are remote from the centers where large amounts of power are used, and the transmission problem is a difficult one. At the present time, the economical limit for electric power transmission is about three hundred miles, but research may modify this materially in the future.

Hydro-electric power development in some cases is not economically feasible unless a considerable proportion of the initial investment can be charged to some other use of the water, such as navigation, or to some benefit, such as flood control. In such a case, the power is essentially a by-product.

Fuels. Radiant energy broadcast from the sun a few hundred million years ago, received by green plants

and stored as chemical energy, constitutes our most important source of energy at the present time. Whether we use it in the form of natural gas, petroleum or coal, we are using up the principal of a deposit which draws no interest and which is not being replaced, at least not at a rate at all comparable to that of its use. It is only a question of time before the day of reckoning arrives when our resources in these valuable materials are used up. How long a time will this be? That is a very difficult thing to answer because it involves a number of unknown factors. Estimates must be based on sources actually surveyed, and are subject to modification as new fields are discovered. This has happened so many times in the case of petroleum that the predictions of geologists about the end of our petroleum supply have fallen into ill-repute. Estimates of time of exhaustion must also take account of the change in the rate of consumption with the time. For example, our known resources of coal have been variously estimated to last from one hundred and ninety to thirty-five hundred years, depending on what rate of increase in use is assumed. The lower figure is based on an eighteen percent increase per year, which is the average annual increase over the past fifty years; the higher figure assumes no increase over the present rate. Our petroleum resources are estimated to last about fifteen years, presumably at the present rate of consumption. Actually of course as we approached the end, the production would gradually diminish, and the last few barrels might still be available after a hundred years or more.

When we think of fuels as a source of energy we generally think of the usual heat-engine cycle. This is a roundabout way of converting chemical energy to electrical work and always involves a step in which heat energy is converted to mechanical energy. From the Second Law of Thermodynamics we know that this step falls far short of one hundred percent conversion, even if the whole mechanism operated in an ideal manner. What are the possibilities for directly converting the chemical energy in a fuel to electrical work? This is a question that has interested experimenters for a good many years and a considerable amount of work has been done with some slight measure of success, but yielding nothing to date of any great promise. From a theoretical standpoint the chemical energy released when the chemical reaction:

$$C + O_2 = CO_2$$

takes place, is all available to do work. In the case of a hydrocarbon the availability would be less; in fact for methane only sixty three percent of the total energy released by combustion is available for work. Turning to the practical side of the problem, any electrolytic cell is a device for converting chemical energy to electrical energy. The ordinary dry cell consumes zinc which would be too expensive as fuel. Cells have been constructed in which the cell reaction is a combustion of a solid or a gaseous fuel but many mechanical difficulties remain to be overcome and, due to polarization, the output of the cells dropped rapidly. One inherent difficulty in any fuel cell is the low intensity factor (of the order of one volt) developed and the consequent necessity of many units in series. At the present time, there is no fuel cell in sight which offers promise of developing into a practical device for the generation of power, and it seems doubtful if an intensive research program directed toward improving such cells is likely to be very fruitful, especially in view of other more promising avenues of approach to the power problem.

Atomic Power. Since the discovery of radioactivity about the turn of the century revealed the tremendous amounts of energy locked up in the nucleus of the atom, men have dreamed of the day when this vast store of energy would be turned to some use. The nuclei of all atoms are composed of the same elemental particles—protons, neutrons, alpha particles (helium nuclei) and possibly a few others that the physicists are not sure about—but most of the atomic nuclei are quite stable configurations. A few, however, are unstable, such as that of radium, and disintegrate spontaneously with the release of almost unbelievable amounts of energy. For example, the spontaneous distintegration of one gram of radium gives off energy equivalent to the combustion of 500,000 grams of coal. There are two good reasons why this particular source of energy will never be of any practical value : (1) because radium is exceedingly scarce; and (2) because it disintegrates very slowly—only one-half of any given amount in 2,000 years—and we know of no way to speed it up. Recently physicists have discovered that artificial radioactivity can be induced in many other elements by bombardment of their nuclei with high-speed atomic projectiles, but the process is hopelessly inefficient. It takes far more energy to induce the temporary activity, than is released when the forced disintegration takes place.

As we have noted, the cause of the great energy release in the distintegration of nuclei is probably the conversion of matter to energy as already pointed out. In order to obtain large releases of energy from a small input, there must be a "trigger" effect or a "chain reaction," by which we mean that an initial impulse must start a whole series of self-propagating reactions, such as occurs when a fuel-air mixture is ignited. No such chain mechanism was known in the field of atomic physics until the discovery less than a year ago of the phenomenon of uranium fission, the implications of which we will discuss presently.

FUTURE POSSIBILITIES

There are three main avenues of approach to the problem of the energy supply of the future, namely:

(1) Further development of well-tried sources
(2) Increase of the efficiency of present energy transformations
(3) Development of new sources through research

There is still considerable undeveloped water power in this country. Some estimates place it as high as 50,000,000 kilowatts, which is considerably more than our present generating capacity in central stations. Due to remoteness from industrial centers, it is not economically feasible to develop much of it at the present time, but with improvements in transportation and in transmission of power and with shifting of centers of population, it will become desirable to consider such development.

Better utilization of our coal supply will come about through improvements in mining methods, in the processing of coal, in transportation and in various other ways, but lack of space forbids any extended discussion. Perhaps the most obvious way to increase our useful energy supply is through greater efficiency in the steps that are involved in the unlocking of the stores of chemical energy in fuels.

Increasing the Efficiency of Energy Transformations. Ever since the time when the first crude steam engines were introduced for pumping water from mines, there has been a slow but steady increase in the thermal efficiency of fuel-power plants. Watt's steam engine was a great improvement over the Newcomen engine, and a further big step was taken when the steam turbine replaced the reciprocating engine, making possible not only higher energy efficiencies but much larger power units. In recent years the trend has been toward the use of

higher temperatures at which heat is taken into the engine, thereby increasing the availability of the heat energy. This is accomplished mainly by the use of higher steam pressures but also by using binary fluid cycles. Modern steam plants now produce one kilowatt-hour of energy on a little less than one pound of coal, corresponding to an energy efficiency of about 28% which may be compared with the maximum possible efficiency (Carnot cycle) of 60% for 900 degrees Fahrenheit intake temperature and 80 degrees Fahrenheit exhaust temperature. With 1,400 pounds per square inch steam pressure and these same temperature limits, the ideal Rankine cycle has an efficiency of 42.5%. The mercury-steam cycle is able to produce one kilowatt hour from 9000 British thermal units, or an actual efficiency of 38%. Diesel engines are theoretically capable of considerably higher efficiencies, and improvements in metals will probably permit us to attain still higher temperatures in steam or binary fluid cycles. Solution cycles, which lack of space prevents us from discussing, may offer promise of material increase in thermal efficiency, and the surface of this subject has barely been scratched. The general conclusion is that there is still considerable room for improvement in the conversion of the chemical energy in fuels to mechanical energy through the use of heat-engine cycles, and significant advances will be made in the next few decades.

After we get mechanical energy from fuels we still dissipate large proportions of it through very inefficient transformation processes. For example, the conversion of electrical energy to produce light is extremely inefficient and only recently great strides have been taken toward improving the luminous output from a given quantity of electrical energy. Much more can be done in this direction.

The Motor Fuel Problem. This appears to be our most acute energy problem, if the statements of most authorities on the world's pertoleum resources are accepted. Without entering into a discussion of this highly controversial subject, let us see what new sources we might turn to in the event of dwindling petroleum supplies.

There are at least six possibilities, and we can only list them and discuss them very briefly. They are: (1) increasing production from wells; (2) increased yields from petroleum; (3) use of solid fuels; (4) use of alcohol; (5) motor fuels from coal; (6) oil shales. The petroleum industry has devoted increasing attention to methods (1) and (2). As a result, the production of oil from a given well has been increased and old wells have been revitalized; the yields of motor fuel from a barrel of oil have been steadily increased, and at the same time the quality has been improved. By efficient utilization of natural and refinery gases, it is possible to make a further substantial increase in the annual production of motor fuels without taking a single barrel more of petroleum out of the ground than we now do.

Although motor vehicles have been developed in Europe to utilize solid fuels, they partake of the nature of curiosities. Since we are blessed with most of the world's petroleum reserves, there probably will be no demand for such vehicles in this country for many years to come.

Alcohol as a source of energy for motor vehicles has been extensively used abroad, and in an experimental way in this country by blending it with other fuels. Unfortunately, the problem of power alcohol has not always been approached from a strictly engineering or factual point of view, but has been mixed up with the political question of relief to the farmer. The facts are relatively simple. There is no question but what alcohol in blends with gasoline or even alone is a satisfactory motor fuel, and processes for making it from almost any carbohydrate material such as corn, sugar cane, sorghum, wheat, cellulosic wastes of various kinds, etc., are well known. Alcohol is not equivalent to gasoline on a volume basis, its total available chemical energy content being only about seventy percent of that of gasoline. The question of its use today is simply a matter of economics. It costs three or four times as much to produce a gallon of alcohol as a gallon of gasoline even with

favorable prices for the raw material.

On the other hand it is comforting to know that we can turn to this source of energy when and if our petroleum resources begin to fail. When, however, one begins to consider the quantity of raw materials necessary to replace our present demand for gasoline, some discouraging facts emerge. The entire wheat crop of the United States in 1935 would produce only enough alcohol to replace about ten percent of the gasoline. All of the corn would have given about thirty percent replacement. The entire United States production of ten principal carbohydrate crops in 1935 would have given about forty-seven percent replacement. It is quite evident that agricultural surpluses would be only a drop in the bucket and if we fuel our cars from this source we shall have to go without these foods for ourselves. Of course it is recognized that cellulosic farm wastes such as stalks, hulls, corn cobs and the like might yield a significant amount of alcohol, but the problem of collection and transportation to a central plant is a big one.

In passing, it is of interest to note that it takes more energy to produce a gallon of alcohol than you can get from it by combustion, so that the net contribution to the available energy supply is a negative one. All you gain is energy in a more conveniently usable form for a specific purpose. No one has apparently given much thought to the question of where the energy for the processing is to come from.

Motor fuels can be made successfully from coal or other solid fuels by at least two processes that have been developed within the past twenty years. These processes are used on a large scale in Europe and can be introduced here if conditions warrant it. It is again an economic rather than a technical problem. The processes have been worked out but the products cannot compete in cost with motor fuels from petroleum.

In oil shales we have another large potential source of motor fuel which we can fall back on if need arises. It is probably true that motor fuel can be made more cheaply from coal or lignites than from oil shales, so that the question of utilizing the shales is one which may be postponed for an indefinite period.

Atomic Energy. There has been a great revival of interest in the possibility of tapping this practically inexhaustible source since the discovery by two German physicists early in 1939 that the atom of the element uranium can be split into two approximately equal parts with the release of an enormous amount of energy relative to the amount of material involved. The process is generally referred to as uranium fission. The few facts that are known are so startling that they have stimulated a great deal of wild speculation by numerous popular writers on science and engineering, and many assumptions unwarranted by the present known facts have been made. Let us try to separate fact from fancy and see whether atomic energy is anything to get excited about.

The known facts in the case at the present time, plus some slight theorizing on fairly sure grounds, may for our present purpose be boiled down to the following:

(1) The energy release per atom of uranium is about 175,000,000 electron volts. This figure is predicted by theory and has been confirmed by experiment. In terms more familiar to the engineer this means that one pound of uranium is equivalent to about 2,000,000 pounds of coal, in terms of total energy that can be released.

(2) The fission process appears to take place only when the isotope of uranium of atomic weight 235 (written U^{235}) is bombarded by slow neutrons. The common isotope, U^{238}, does not appear to give the reaction. U^{235} constitutes only 0.7 percent of ordinary uranium as it occurs naturally and the same ratio would hold for any salt of the metal.

(3) Fission appears to be a chain of self-propagating reaction but this has not yet been confirmed experimentally. To secure the chain reaction will require that the U^{235} isotope be concentrated to some point still undetermined.

(4) Only a few millionths of a gram of U^{235} have been separated from ordinary uranium by the mass spectograph.

(5) The fission is produced only by slow neutrons which can be made from the more common fast ones by placing in their path water or paraffin or any substance with a large proportion of hydrogen.

(6) The exact course of the reaction is not known. A number of different atomic fragments have been recognized.

The extrapolation from these slender facts to a practical scheme for producing power is enormous, and it will certainly take a lot more knowledge than we now possess to bridge this gap, one so lightly skipped over by the "popularizers" of science. Assuming that fission is a chain reaction, if the U^{235} isotope is to be concentrated, how might the concentration be accomplished? Isotopes differ only in mass and hence a separating process must be based on this property. Two methods have been suggested: (1) use of the ultra speed centrifuge; and (2) thermal diffusion. Both methods have been successfully used for other isotope separations but the situation is a particularly unfavorable one in this case because of the small percentage difference in mass between the two isotopes. These methods operate best on gases and it is interesting to note that only one compound of uranium is known that is a gas at ordinary temperatures. This is uranium hexafluoride, which is a solid at room temperature but sublimes to a gas at about fifty-six degrees Centigrade. No results have been reported as yet on the separation of the uranium isotopes by either of these methods. Even in a much more favorable case than this, the thermal diffusion method, which appears to be the one offering most promise, is very slow and the energy efficiency is low. From some recently published estimates on separation of uranimum isotopes by thermal diffusion and from actual data on the separation of carbon isotopes, it appears that the energy efficiency of the process is such that the energy requirement for a concentration of the U^{235} isotope from the present 0.7 percent to about ten times this value is considerably greater than the energy which would be released if all the U^{235} so concentrated were to be subjected to fission. Further research may point the way to increase the efficiency of the separation process or reveal other ways of accomplishing it with a smaller energy expenditure. We must conclude, however, that there is no way in sight at the present time of bringing about a reasonable concentration and leaving a favorable energy balance.

No one has yet produced anything more than an insignificant amount of energy from uranium fission, but on the assumption that the concentration problem could be solved, various scientists have speculated on the methods of generating power. The amount of material available is not a serious obstacle. Although uranium ores are not exactly common, still the known supplies are certainly sufficient to generate a very large amount of energy. The mechanism for starting the fission can be quite simple and does not involve the large and impressive cyclotrons or electrostatic generators that one usually associates with atom-splitting experiments. A mixture of radium and beryllium is a source of neutrons and water will slow the neutrons to the point where they can start the fission, and once started it

iould propagate itself just like a ›mbusion reaction. Since the fission self apparently evolves fast neu-›ons, the presence of liquid water ill apparently be necessary to insure ›ntinuance of the reaction, and this ın be used as a means of control. hus the uranium salt or oxide would ›t like a fuel and deliver its energy s heat to a working fluid which ›uld then be used in the ordinary ay in a heat engine. This may ap-›ar to be a bit fantastic but still it not beyond the bounds of possibil-y. It does, however, appear to me be quite absurd to go on and spec-ate on the many ways in which we ight utilize this power and to pre-nd that the whole way of civilization ll be revolutionized by it when we ve not yet produced from this source single British thermal unit.

GENERAL CONCLUSIONS

(1) For many years to come we ll continue to depend on fuels and falling water for power. There is nothing in sight at the present time which can take their place on any appreciable scale. There will be steady increases in the efficiency of producing and utilizing fuels which will probably meet the increasing demands for power. More water power sites will be developed.

(2) Direct conversion of the chemical energy of fuels to electrical energy has made little progress and there is nothing in sight at the present time to lead one to expect any practical developments.

(3) In spite of the predictions of exhaustion of our petroleum reserves in fifteen or twenty years, discovery of new fields and advances in producing and refining technology seem likely to postpone this for several decades. When petroleum production is definitely on the wane we can turn to methods already developed for producing motor fuels and fuel oils from coal. Alcohol from carbohydrate crops and farm wastes can also supply at least a part of our needs.

(4) Power from tides is technically possible but will probably remain economically unfeasible for many years.

(5) Power from the earth's heat or from temperature differences in the ocean offer little promise as future large-scale sources of power.

(6) Direct use of solar radiation is not very promising in the light of present knowledge but long-range research on the problem should be continued in the hope of making discoveries which may alter the picture.

(7) Recent discoveries have placed atomic power at least within the bounds of possibility but most of the stories about it in the public press are quite fantastic and without a basis in established fact. Research should, of course, be intensively pursued not necessarily with this end as a definite goal but purely in the spirit of the search for truth, with the possibility of finding the key to atomic power as a by-product.

These conclusions are simply one person's predictions based on the available evidence, and predictions are always hazardous. I am reminded of the following prediction of the great French philosopher, August Comte: "There are some things of which the human race must forever remain in ignorance; for example, the chemical constitution of the heavenly bodies." Comte died in 1857 and just two years later Bunsen and Kirchhoff announced their discovery of spectrum analysis. Only ten years later Janssen and (independently) Lockyer discovered helium in the sun, which was long before its discovery on the earth. Who would have the temerity to say that any of the sources of energy that now seem fantastic to us can never become practical realities even in our lifetime?

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Removal of ultra fines also eliminates cemented areas in the fuel bed, blow holes and lowered efficiency in many other ways.

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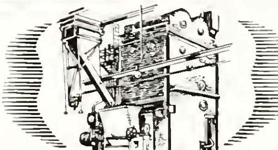

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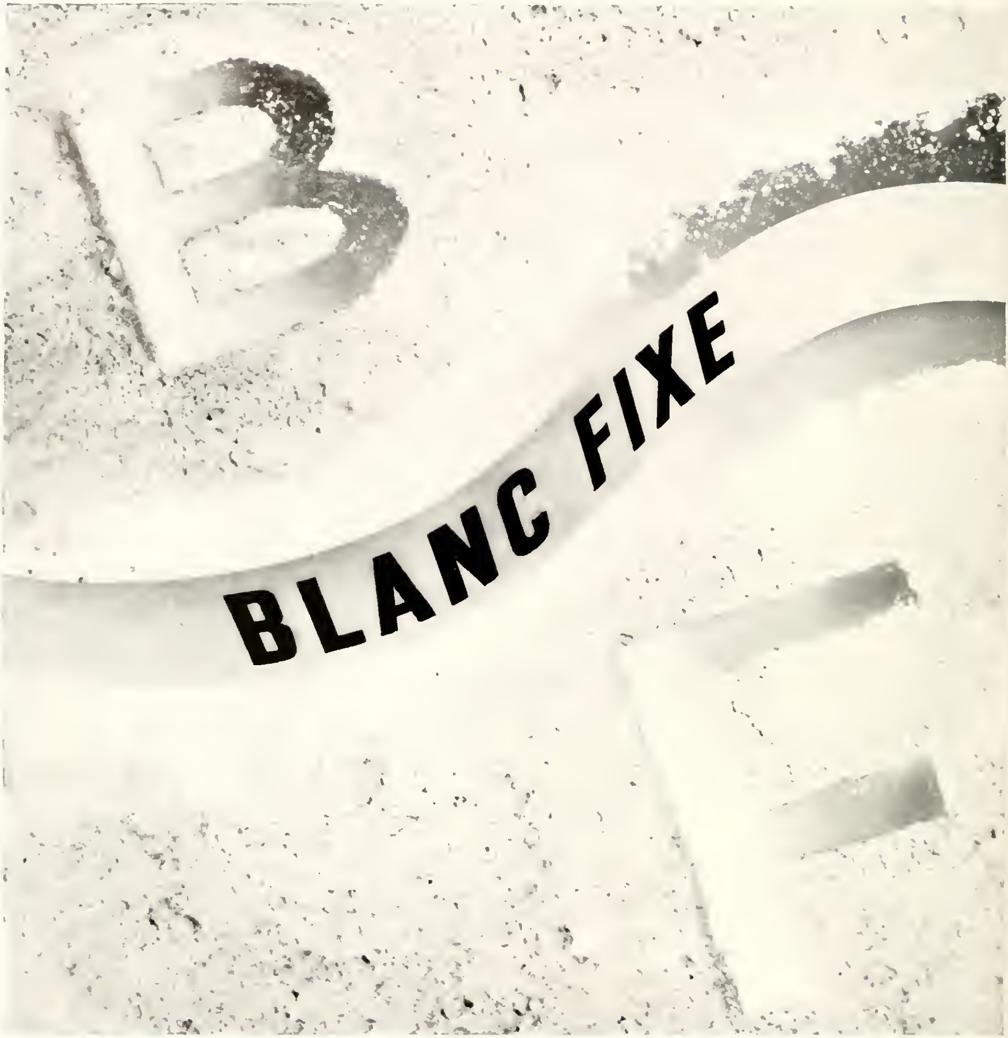
Do you smoke the cigarette that Satisfies
200
Chesterfield
20's
Chesterfield
The attractive Gift
Carton that says
Merry Christmas

ARMOUR ENGINEER

AND ALUMNUS

MARCH, 1941



BECAUSE of its remarkably pure and uniform white color Witco Blanc Fixe is winning wide favor in many industries. More and more manufacturers are standardizing on it as the completely reliable Blanc Fixe for use in products where quality and uniformity of results are essential. Advantageous, too, is the absence of free alkalinity or acidity, achieved by the unusually rigid methods Witco employs to control its neutrality. The result is that it may be used with confidence for a great variety of purposes. You are invited to send for trial quantities and make tests in your processes. Witco Blanc Fixe is available in 50 and 100 lb. bags and 350 lb. barrels.

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BUY DIRECT AND PROFIT DIRECTLY

G-E Campus News

FLOATING POWER

BACK in '29, when the water supply in Tacoma, Washington, was so low that the hydroelectric stations could not generate enough electricity for the city's requirements, the U.S.S. *Lexington*—a turbine-electric drive airplane carrier—supplied the power necessary to tide the city through the emergency.

A year later on the opposite side of the country, the *Jacona*, a ship built during the last war, was made into a floating power plant by installing two 10,000-kw turbine-generators in its hull. It is at present in service on the Piscataqua River near Portsmouth, N. H.

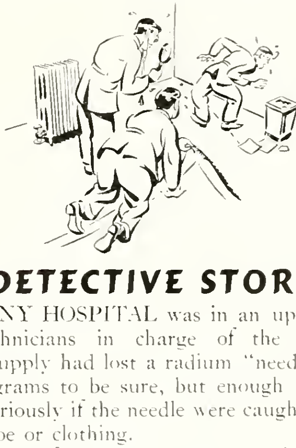
General Electric is now studying the possibilities of a 50,000-kw floating power plant, which could be towed through America's coastal and inland waterways and hooked up to regular distribution lines to generate electricity in emergencies. Such a generating station could be housed in a hull similar to that of a lake freighter.

GIANT ATOM SMASHER

SO powerful that its atom-smashing beam of ions would melt an ordinary brick as fast as a blowtorch would melt a pound of butter will be the U. of California's new 100,000,000-volt cyclotron. The 4900-ton giant—16 times more powerful than the present outfit—will generate atomic energies greater than any now in existence except in distant stars or elsewhere in cosmic space.

Atomic particles will be fed into a circular chamber where they will receive successive "kicks," whirling them around in continually widening circles until they reach a window or port on the side of the chamber. The element to be bombarded will be placed over this window where it will receive the full force of the ion beam.

For this machine General Electric is building electric equipment, which will occupy the space of a two-story house. The chief function of this equipment will be to make ordinary electric current capable of operating the giant atom smasher.



DETECTIVE STORY

ALBANY HOSPITAL was in an uproar. The technicians in charge of the hospital's radium supply had lost a radium "needle"—only 3.3 milligrams to be sure, but enough to burn a person seriously if the needle were caught for long in his shoe or clothing.

An appeal for help was sent to the General Electric Research Laboratory in Schenectady for a "Geiger Counter"—an electric "ear" which detects and amplifies the otherwise inaudible "explosion" of the radium as it breaks down.

When Dr. C. W. Hewlett (N. C. State, '06) of the G-E Research Laboratory entered the suspected operating room, the counter immediately began to "cluck" its warning of radioactivity nearby. After a false start, the counter took to the trail like the Hawkshaw it is, and eventually, as Dr. Hewlett lowered it to the floor in front of a radiator, the clucks became barks. And there, snuggled against the wall under the radiator, was the missing radium.

GENERAL ELECTRIC

953-15

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George W. Petersen graduated from the Department of Civil Engineering at Armour Institute of Technology in 1933. Before graduation he had been employed by several material and contracting firms. From 1933 until November 1940 he was with the Public Works Administration serving for five years on the Loup River development as Supervising Engineer and as Chief Resident Engineer Inspector. He is now Field Supervisor and Engineer for the National Youth Administration.

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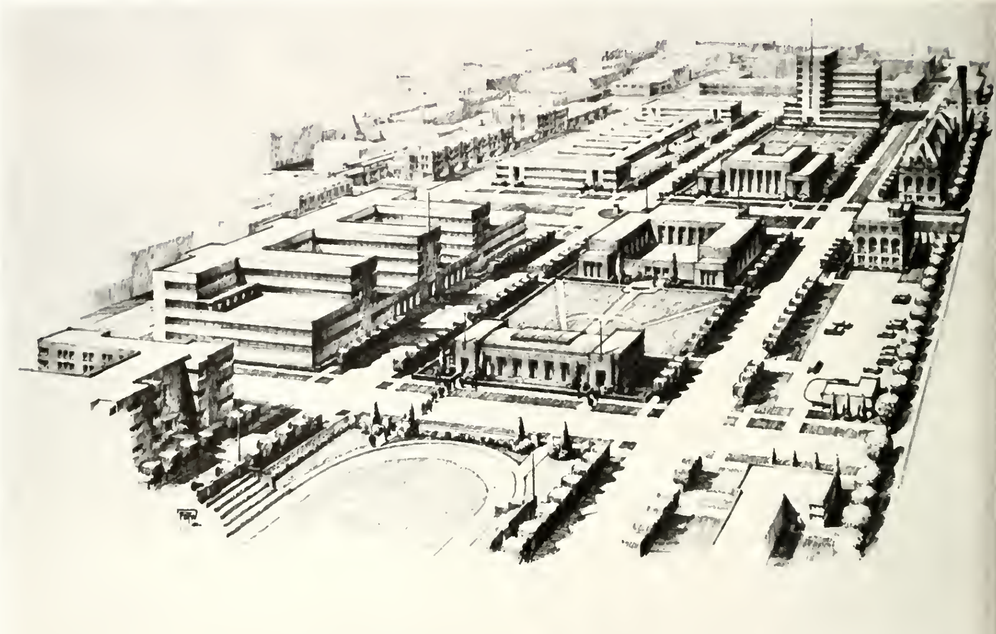
THE NEW CAMPUS



ILLINOIS INSTITUTE OF TECHNOLOGY CHICAGO

An Architect's Idea of the New Institute

Plans for a new Armour campus, conceived a decade or so ago, are to be consummated in a greatly enlarged campus which will house all day student activities now conducted by Illinois Institute of Technology at Armour College of Engineering and Lewis Institute of Arts and Sciences.

Announcement of this development, which involves a building program of $3,000,000, was made by James D. Cunningham, chairman of the Board of Trustees, at a luncheon of more than 100 of Chicago's civic and industrial leaders, held in the Chicago Club on January 13. Speaking on the same occasion, Wilfred Sykes, chairman of the Board's policy committee, and President Henry T. Heald of the Institute described the program's objectives and emphasized the significance of the recent Armour Lewis merger, particularly in its relation to industrial development in the Mid-west area of which Chicago is the center.

Even prior to the merger, which was formally completed in July of last year, Armour Institute of Tech nology trustees were quietly at wo acquiring title to various parcels land adjoining the Armour camp on the South Side. Mr. Cunningha revealed. As a result, the new ca pus will embrace six blocks exten ing from 32nd to 34th Street, a from State Street to the New Yo Central-Rock Island railroad track

Financing of the program will r quire, in addition to $3,000,000 f the construction and equipment new buildings, the development

new income sources capable of producing $275,000 annually. Translated into terms of endowment at current yield, this would mean the addition of virtually $9,000,000 to the Institute's present capital funds. It is expected, however, that a portion of this income can be secured in the form of continuing annual gifts from industry and other sympathetic quarters.

Illinois Institute of Technology has become, as a result of the merger, the largest institution of its kind, from the standpoint of enrollment, in the United States. During the current scholastic year it is anticipated that no less than 7,000 students will enroll in all sessions.

In addition, the Institute, cooperating with the federal government, already is providing instruction for some 1,500 men, many of them graduate engineers, in intensive engineering courses which constitute a part of the national defense program, and as this issue of THE ENGINEER goes to press, plans are being perfected for the training of an additional 1,000 men in such classes.

At the beginning of the present school year, engineering activities, with the exception of certain freshman courses, were concentrated upon the Armour campus, and it is deemed essential in the interest of economy and efficiency that all day-student activities be limited to a single campus. This cannot be accomplished until plant and equipment adequate for the accommodation of 2,500 day students are provided, and the operating margin between educational costs and calculable income from existing endowment and student fees is covered. The current development program is designed to meet this situation at the earliest possible date.

The building program over the next few years includes the following specific projects: a Library and Humanities Building, a Metallurgical Engineering Building, Engineering and Science Buildings, a Student Union, a Physical Education Building, the first unit of a Mechanical Laboratory Building, and a Power Plant.

The first phase of this program, involving construction of the Library and Humanities Building and the Metallurgical Engineering Building, will be launched just as soon as the necessary funds are secured. This financing, as well as the development of the increased annual income sources required for operation of the activities which they will house, is to be undertaken at once.

For this purpose, the policy committee of the Board of Trustees has been resolved into a finance committee for the purpose of approaching industry, the community, alumni, and other friends for the necessary financial support.

The policy committee consists of Wilfred Sykes, Assistant to the Pres-

A Portion of the Present Institute

Above: This Familiar Unsightly Corner Will Change Its Face

Below: Slum Dwellings Like These Will Be Replaced by Modern College Buildings

ent of Inland Steel Company, airman; James D. Cunningham, airman of the Institute's Board of rustees and President of Republic ow Meters Company; Charles S. avis, President, Borg-Warner Cor- oration; Henry T. Head, President the Institute; Sydney G. McAllis- r, President, International Harves- r Company, and Charles B. Nolte, resident, Crane Company.

A Development Office has been ened by the Institute on the 7th or at 79 West Monroe Street, Chi- go, and the organization of per- nnel for prosecution of this phase the appeal is well under way.

During the last four weeks a series invitational group meetings has en initiated under the sponsorship a special committee headed by homas Drever, President, American eel Foundries. These meetings, at- nded by outstanding industrialists d business men of the community, e devoted to explanation of the ogram and of plans for its financ- g.

Already associated with Mr. Drever chairmen of individual meetings e: Alexander D. Bailey, Vice- hairman, Chief Operating Engineer Commonwealth Edison Company; ames D. Cunningham; Arthur J. R. urtis of The Portland Cement Asso- ation; Charles S. Davis; Newton C. arr of Farr and Company, realtors; dolph H. Fensholt, President, The ensholt Company; John M. Frank, resident, Ilg Electric Ventilating ompany; Edwin O. Griffenhagen of iffenhagen and Associates, account- ats; Robert B. Harper, Vice-Presi- nt, Peoples Gas Light and Coke ompany; Frank A. Hecht, financier. Charles W. Hills, Jr., of the firm Charles W. Hills, attorneys; Ray- ond J. Koch, President, Felt and arrant Manufacturing Company; J. arren McCaffrey, attorney; Ber- rd L. McNulty, President, Marble- ad Lime Company; Samuel Marx, chitect; Harold W. Munday, Vice- esident, McGann Manufacturing ompany; Harris Perlstein, Presi- nt, Pabst Brewing Company; Pro- ssor John J. Schommer; Bernard Sunny, Director, Illinois Bell Tel- hone Company; Harold A. Vagt- rg, Director, Armour Research undation; Harry A. Wells, Presi- nt, Wells Securities, Inc., and Ben- min Wham of Wham and O'Brien, torneys.

A publicity committee is also being ganized to function as part of the nd-raising organization under the airmanship of James M. Rodger, ce-President and Western Mana- r of McGraw-Hill Publishing Com- ny.

In discussing the development program, Mr. Sykes recently called attention to several aspects of the industrial situation which make necessary the development of a "great technological center" for service to industry in the Mid-west area of which Chicago is the hub.

He pointed out that 25 percent of the working population of this region is engaged in the manufacturing, communication, and transportation industries, which constitute the gauge of demand for trained engineers, and that this Chicago area represents one of the largest concentrations of industry in the country, with twice as many individuals engaged in these industries as there are in any other metropolitan area with the exception of New York. He added that the number of engineers per worker employed here has increased more rapidly than in any other city in the United States.

In the light of these facts, the Trustees of the Institute feel that by any yardstick Chicago should have a school of the industries comparable in every respect to the best in the country. By way of comparison, they have adduced the following figures:

Massachusetts Institute of Technology in the East has an enrollment of 3,093 students, a $14,000,000 plant and an endowment of $36,-230,000.

California Institute of Technology on the Pacific Coast has 862 students, a $7,759,000 plant and an endowment of $11,456,000.

Illinois Institute of Technology, on the other hand, while having an approximate annual enrollment of 7,000 day and evening students equivalent to 3400 full-time students, has only a $2,200,000 plant, and an endowment of only $1,861,000.

Success in the present development is counted upon in large measure to correct this discrepancy.

Selection of the Library and Humanities Building and the Metallurgical Engineering Building as the two units in the construction program to be financed during 1941, has been made in view of the urgency of the need, it is explained by President Heald.

Erection of the Library and Humanities Building will permit the transfer of all day-student activities from Lewis Institute to the new campus at the earliest possible date. At the same time it will release for other essential activities space in old Chapin Hall now devoted to mathematics and other courses to be permanently housed in the Humanities unit.

The Library unit will not only permit proper development of the Institute's reference resources and a consolidation of Armour and Lewis book holdings, but will accommodate administrative offices and free much-needed space in the old Main Building for use by the Electrical Engineering Department.

At present Illinois Institute of Technology has no curriculum in Metallurgical Engineering, and cannot take its place among the great technological centers of the country until this deficiency is remedied. Erection of the Metallurgical Engineering Building will not only provide for this department but will also free space in existing campus buildings urgently required by the Mechanical Engineering Department, until such time as suitable quarters for the latter can be provided.

Construction and equipment costs are estimated as $1,018,000 for the Library and Humanities Building, and $256,000 for the Metallurgical Engineering Building — a total of $1,274,000.

The 1941 financing effort is designed to raise this money and at the same time to develop new income sources to provide $150,000 annually. It is hoped to assure this income through the addition of approximately $4,300,000 to existing endowment, or through continuing annual gifts aggregating $150,000, or throuh a combination of both.

In connection with this program, the Board of Trustees has drawn up a "Definition of Purpose," in which they state the position of the Institute as follows:

"Illinois Institute of Technology believes

"That the future of the United States depends, as never before, upon scientific development of our natural resources . . . human and material.

"That our youth must be schooled in the principles of true Americanism . . . that they may apply their knowledge to the preservation and improvement of our social, industrial and economic welfare.

"That technological training, supplemented by a knowledge of the humanities and social sciences, is an essential requirement for the task ahead.

"That this training must accord with the highest scholastic standards.

"That 'brains' are where you find them, and, this being so, that the Institute's service must be kept available to those of modest means and to those who must earn as they learn.

"That the Institute's resources should be devoted to the advancement

(Turn to page 51)

35 WEST 33RD STREET

By

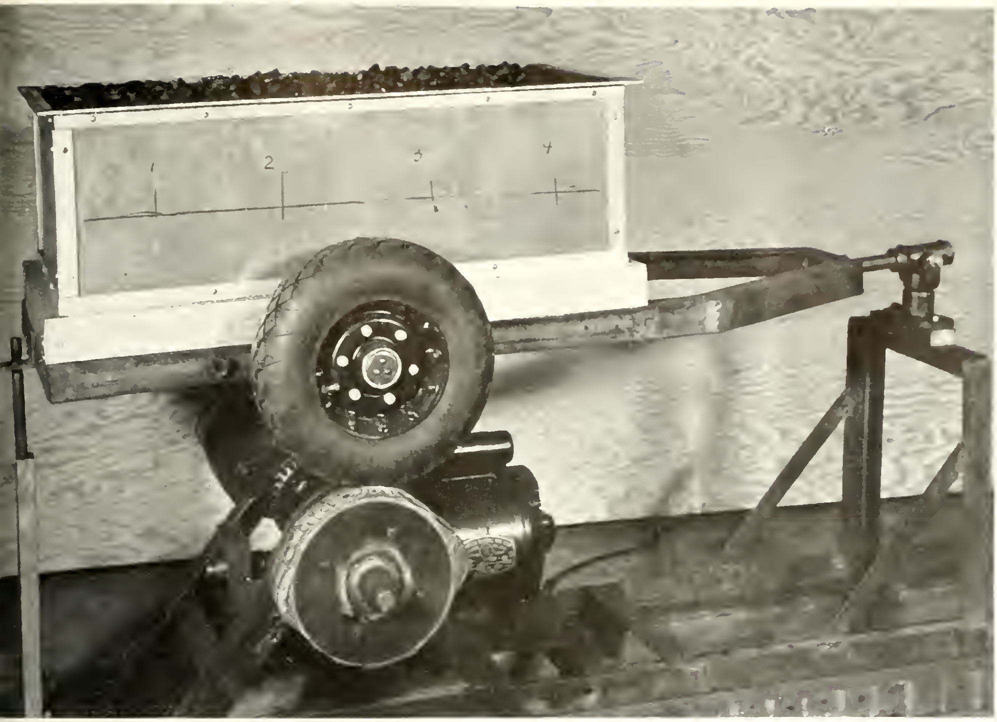
FRANCIS W. GODWIN

At the corner of Thirty-third and Dearborn Streets stands a weathered three-story building. As one of the units of the famous Armour flats, it was already a part of Chicago's written history when its present work began. In external appearance the only change has been the addition of eighteen bronze letters spelling "Research Foundation" over an arched stone doorway. Under these letters now pass the newest things in the world.

In September, 1936, the Armour Research Foundation — then called the Research Foundation of Armour Institute of Technology — was born as a not-for-profit institution to serve industry in scientific research and experimental engineering. Unlike its two sisters (Mellon Institute of Industrial Research at Pittsburgh and Battelle Memorial Institute at Columbus) the Armour Research Foundation did not "spring fully armed" from a huge endowment, but made a relatively modest beginning. It was determined that its success or failure must depend upon its value to the industries and the nation that it was to serve. Growth would come naturally in proportion to its service, for industry would pay the bills if the benefits derived exceeded the outlay.

The first laboratories were on the ground floor of the building at 35 West 33rd Street. Today, after four and one half years and never a dull moment, the Armour Research Foundation's activities occupy four buildings in addition to a number of supplementary laboratories. Plans for another unit are already on the drawing boards, and even more space will undoubtedly be needed by the time this is printed. The original building is now the nerve center of the organization, housing the offices of administration and most of the scientific staff as well as many of the spe

Multiple X-ray diffraction camera for studies in crystal structure and atomic distribution.



A scale-model aluminum alloy truck running loaded over a mechanical "rough highway" in a performance test.

ialized laboratories. Taken in order f acquisition, the next is a smaller uilding once known to Armour lumni as the "Ice Lab," now devoted hiefly to fuel and combustion studies. 'his structure boasts no less than five nokestacks, and its interior is rowded with various types of high nd low-pressure boilers, furnaces, toves, stokers, and similar equipment, s well as a 400,000-pound testing achine. The third building, soon to e doubled in size, is a special one ccupied with foundry research. Of articular note here is machinery 'hich die-casts iron under pressure. 'he latest building to be added is a arger one of modern factory type onstruction, housing a number of inustrial process pilot plants, a large Diesel engine laboratory with six engines equipped with dynamometers, and the greatly expanded Research Foundation shops wherein are produced the numerous special instruments and articles of research equipment not generally available. These shops, manned by a staff of expert machinists, welders, carpenters and electricians, supplement the scientific staff in the construction or alteration of machines and devices under development, and minimize research delays such as would ensue if dependence had to be placed on outside shops already crammed with backlog orders.

The Armour Research Foundation is essentially the combination of a staff of highly trained industrially-minded research men in the various fields of engineering and science, together with the physical plant and laboratory facilities necessary for these men to develop the new things that industry wants. Although affiliated and working closely with the Illinois Institute of Technology, the Research Foundation is in reality a separate corporation with its own Board of Directors, officers, staff and facilities. This permits such desirable features as confidential unpublished reports of specific investigations and the assignment of patent rights to sponsoring companies. Research is done rapidly by full-time men, a large portion of whom hold a Ph.D. degree. In addition to technical training, primary requisites for staff members include ingenuity, imagination, enthu-

siasm, a co-operative spirit, and an understanding of the industrial viewpoint. Such men do not grow on trees and accordingly are retained as permanent staff instead of being hired on a "fellowship" basis for the duration of a specific project.

Approximately a thousand companies, individuals, and associations of manufacturers in all parts of the United States have utilized the services of the Research Foundation. To date 120 long-term research projects have been undertaken, each for the development of some new or improved process, method, equipment or product. Apart from the sponsored projects, a number of fundamental research projects are constantly in progress, aimed at the creation of new scientific tools to make possible further advancement of the frontiers of science and industry.

For purposes of administration and co-ordination of the work the Foundation is separated into seven broad divisions of scientific endeavor, namely: Ceramics and Nonmetallics, Chemical Engineering, Chemistry, Electricity and Sound, Experimental Engineering, Light, and Metallurgy. Each of these has its specialized staff of men trained in the particular field and headed by a division director responsible for the conduct of investigations under his charge.

A research project may begin with a letter from an executive of a large manufacturing company in, say, Dayton, Ohio. The company is attempting to work out certain improvements in its process which, if successful, can save many thousands of dollars per year. As a matter of fact, the company has its own research department, but, as is the case more often that not, there are so many rush jobs of trouble-shooting continually cropping up that this department simply cannot concentrate on the longer-term development. Every passing day means money lost until the improvements are successfully incorporated.

After a brief correspondence in which the policies of the Research Foundation are outlined, a meeting is arranged. Present are the company executive and a number of his technical men, as well as the several members of the Research Foundation staff whose fields are concerned in the problem. In the discussion the details are brought out and it becomes clear that the problem is one for the Metallurgy Division.

A tentative plan of investigation is offered for approval. Meanwhile both the sponsor and the Foundation appoint members of a joint steering committee. A standard agreement form is prepared, stating the objectives

Special Knudsen-type direct reading high vacuum gauge developed for study of vacuum pumps.

of the project, providing for written reports, treatment of findings in strict confidence, assignment of patents, and reserving the particular field of study exclusively for this sponsor for the duration of the project. With such details taken care of, work is started at once. One man (more if necessary) is assigned to the task and in this case it is a suitably qualified metallurgist. Probably his first act is to make a critical inspection of the Dayton plant, unless this was done in the preliminary period. His early findings will determine the next steps.

If in the course of a metallurgi project it becomes necessary to m some X-ray studies, the Light Divis is called in. If the process machin demands a special electronic cont or perhaps a removal of vibration, services of the Electricity and So Division are available at once. T each sponsor pays for a single m but his project receives whatever tention is needed from a staff of si whose range of specialization co virtually anything, however ur pected, that may develop during work.

The past eighteen months of

Research Foundation's service to industry have been especially marked by increasing facilities for the investigation of industrial problems of an ever broadening variety. Significant advances have been made in all divisions, and in several instances large additions have been effected at a single stroke.

With the absorption of the Ceramics Department of Lewis Institute by the Ceramics and Nonmetallics Division on September 1, 1940, there came into being one of the most completely equipped and staffed ceramics laboratories in the Middle West. Special equipment now available in the combined laboratories includes kilns and furnaces, ball and pebble mills, grinding, mixing and blending machinery, temperature measuring instruments and analytical apparatus. For research by high temperature and petrographic methods the petrographic laboratory is provided with both polarizing and reflecting microscopes, supplemented by attachments and by cutting, grinding and polishing discs and caps, as well as an electrically heated hydraulic press for imbedding materials in plastics for examination. A large set of calibrated refractive index media is kept at hand for powder studies and mineral identification by the oil immersion method. Studies in progress include investigations in refractories, enamels and pencil leads.

In the Chemical Engineering Division, laboratory space has been increased by one additional unit of 1200 square feet and another of smaller area. The first of these is being devoted to industrial food processing research and includes, as one item of its equipment, an experimental flour mill. The second houses a complete air conditioned pilot plant for the development of chewing gum manufacturing processes on a full scale. Other laboratories of this division are currently producing developmental information in certain drying processes, commercial containers, and the program of solid fuel preparation and combustion studies which has continued in several new channels since the establishment of the Research Foundation.

The Chemistry Division has acquired an additional laboratory to be utilized for investigations in bacteriology and the biological aspects of chemical research. Special equipment is now being installed for these studies and will include incubators, autoclaves, centrifuge, microscopes and auxiliary apparatus. Research in this division has advanced in recent

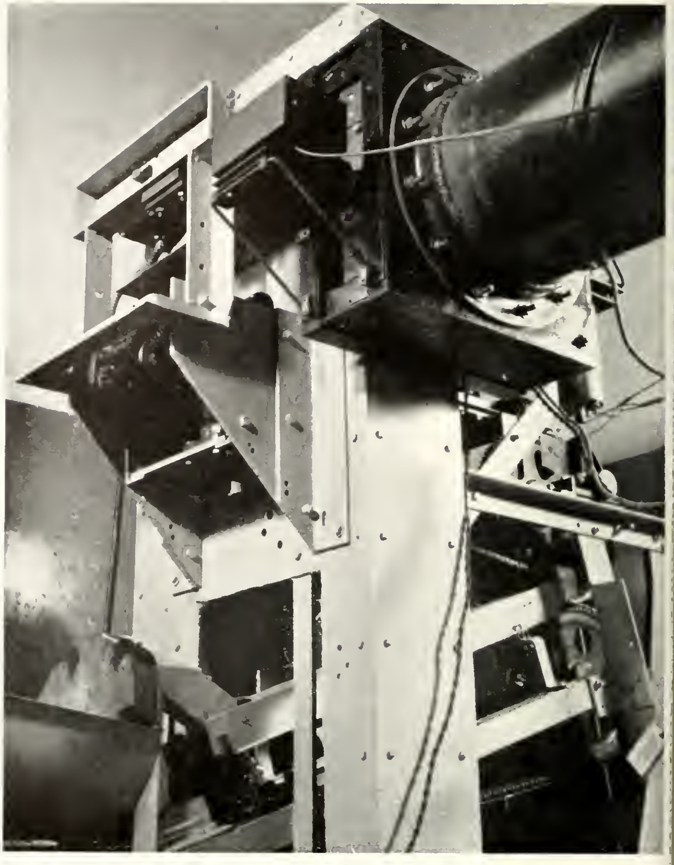
A load of die-cast iron pipe flanges from the experimental foundry.

months on numerous fronts, a partial list of which includes industrial proteins, shellac, meat products, plastics, coatings, adhesives, inks, cosmetics, and plywood.

A combination sound-proof and electrically shielded room has been added to the already extensive facilities of the Electricity and Sound Division. The electrical shielding of this room is said to be second to none, and has proved itself especially valuable in radio interference studies. Newly added equipment in the laboratories of this division includes a noise and frequency analyzer and recorder, large cathode ray oscilloscope, and logarithmic amplifier. Among the current studies of particular interest are investigations of noise characteristics of pipes and valves and the development of calculating machines, sound recording equipment, air compressors and remote control.

The Experimental Engineering Division is maintained primarily to carry on work of an engineering and testing nature incident to the development of a wide variety of machines and products. To this end the division has in the past year increased its utility considerably with three new laboratories. One of these now houses the recently built apparatus for flight performance testing of golf balls. In another a set of three wind tunnels, one of them ten feet in diameter, is being erected. The new Diesel Laboratory is the largest and has been in continuous twenty-four-hour operation since its installation. Six engines are in place, with another six soon to be added. An overhead traveling hoist assists in the studies, as regularly scheduled take-down and assembly of engines is involved. Lubrication tests are further aided by the recently acquired high pressure lubricant testing machine. Improvements have also been effected in older laboratories, and a short time ago an added chamber within the constant temperature room made possible the attainment of a wind of 200 miles per hour at 67 degrees below zero.

More than 100 long and short-term investigations have been undertaken by the Experimental Engineering Division during the past year, including such subjects as coal stokers, stoves, crane girders, exhaust blowers, fans, gear reducers, golf balls and implements, lubricants, solenoid brakes, catalyst measurements, thermal insulation, window shades, window construction, wall plaster, air conditioning equipment, vapor-proof and water-proof linings, copper roofs, skylights, automotive testing equipment, relief valves and similarly dissimilar items.



Automatic golfer which tees the balls, drives them, measures their flight and sorts them at machine-gun speed.

A Steam Laboratory equipped with a generator capable of producing 3,000 pounds of steam per hour at 750 pounds pressure is in operation. Additional units also provide steam at 90 to 100 pounds pressure in quantities up to 10,000 pounds per hour if demanded, as well as smaller quantities at any pressures up to 1200 pounds per square inch. These units, with condensing and vacuum-producing equipment and similar items, offer exceptional facilities for testing and development work on steam heat-transfer apparatus. Unique features include equipment wherein the flow of steam through nozzles and orifices can be observed directly through glass windows. One such unit incorporates a Venturi-shaped nozzle, the angle between the sides of which can be varied while the steam flow is under observation. Designed for fundamental study of the expansion of saturated steam, this apparatus is also suitable for special projects in flow at moderate pressures. Many problems in the flow of fluids require the use of small-scale

(Turn to page 52)

RESEARCH IN THE DEPARTMENT OF CHEMICAL ENGINEERING

By
ROBERT C. KINTNER

Distillation column constructed entirely of stainless steel.

The field of endeavor of chemical engineering covers the design, construction and operation of plants for the manufacture of products, the processes for which involve change in state or composition. Such processes usually involve bringing materials together under such controlled conditions that the chemical reaction will proceed in the proper direction, at the proper speed, and to the proper degree of completion. When this result is attained, the products of the reaction are separated, purified and packaged for shipment to the customer. Any contribution, then, which allows us to improve the design, construction, or operation of these plants is gratefully accepted by the chemical engineering profession. It is the duty and the pleasure of every first rate college laboratory to be constantly endeavoring to make more and more of these contributions through the medium of research.

Dr. T. H. Chilton of the duPont Company has enumerated some of the problems of chemical engineering as: "How to transport, meter, compress, and rarefy gases? How to propel and proportion liquids; how to contact them with gases or other liquid phases, and separate them again? How to subdivide or to compact solids, and to contact them with gases or liquids? How to separate solids from gases or liquids, or from other solids according to properties or particle size? How to supply or withdraw heat?" Due to the enormous variety of materials used in the chemical industries, there will be unknown quantities in the above list for many years to come; probably forever.

Projects for research are the result of someone's need of a tool for the better design, construction or operation of a plant. When the tool is not in existence, he will set about fashioning a tool to suit the situation. If he is a part of a specific industry

Equipment for the study of heat transfer by radiation.

and needs the tool for a specific problem in that industry, the tool will probably be a specific one of very narrow utility. If he is being paid by a corporation, particularly one in a highly competitive field, the new contribution may not come into general use for many years. But if he is a part of the staff of a chemical engineering department of a college or university, the tool will be presented for all to use and the contributor will be proud of his part in the advancement of the art. The majority of the papers on the programs of our national societies are given by college teachers and their students. Some years ago, Dr. F. C. Vilbrandt of the Virginia Polytechnic Institute made the statement, "Research begets research." The problem arising out of the need for a tool, no matter how simple, invariably starts a chain of events and in a very short time the worker finds himself swamped with a multitude of unanswered questions, of varying degree of importance and magnitude.

Research projects may be divided into those of a very fundamental nature, which usually come to light as a result of research on some problem of more immediate concern, and specific projects in which the answer to a problem of limited applicability is sought. A few examples of projects now in progress in the Chemical Engineering Department of the Armour College of Engineering may be of interest here.

The research project receiving most consideration over the last three years has been one concerned with the production of spinnable fibers from flax and hemp. In this project, under the direction of Professor Harry McCormack, the discovery that amines are solvents for the non-cellulosic material in plant tissue has been the foundation upon which the work has been based. Various experiments have been conducted to determine the most satisfactory operating conditions as to temperature, pressure, and time for treating the cellulosic material with various amines. This part of the procedure has been standardized and the suitability of some fifteen amines as treating agents has been investigated. Pure, clean flax and hemp fibers have been produced in quantities up to fifty pounds each. Certain other possibilities of the solvent action of the amines are being investigated. As the amines are solvent for all of the materials except the cellulosic materials, it is evident that the solution contains such materials as pectose compounds and lignin, originally present in the plant tissues. Methods have been investigated for the isolation and recovery of pectin and pectic acid in pure form, and the isolation and utilization of the lignin present in the amine solution is being attacked.

The mineral resources of the United States have come under investigation in our laboratories, and methods for the production of soluble ammonium chromium sulfate by heating chrome iron ore with ammonium sulfate commence to show some promise of a successful culmination. This investigation has proceeded to the point where it is certain that the major chromium content of a chrome iron ore can be secured in the form of a soluble chromium salt. The treatment of titaniferous materials with ammonium sulfate is under investigation and it is indicated that the final product can be obtained as titanous hydroxide. A study is being made of the possibility of the beneficiation of various manganese ores of the United States.

In the drying of food products many problems such as coloration and checking are always a source of constant inconvenience to the producer.

A modern humidity cabinet is being built under the supervision of Dr. R. E. Peek that will have several important features necessary for proper conditions in drying food. A stainless steel shell of welded construction and a blower having a Bakelite-lacquered fan will insure freedom from contamination. All temperatures and humidities will be automatically controlled to assure stable conditions within the humidity chamber. It is hoped that the drying curves analyzed from a sufficient number of runs will give the correlation necessary for the development of drying formulae.

Photos: G. A. Raymond, R. E. Zelin

High-pressure autoclave used in the production of spinnable hemp fibers.

A two-inch by eight-foot stainless steel distillation column, packed with carbon rings, is being used to obtain more complete and reliable information on the design and operation of packed column stills. From the operating data obtained, design factors can be calculated, and correlations of these factors on the basis of mass diffusion and the physical properties of the mixture being distilled can be made.

Filtration is one of the oldest of the chemical engineering operations, yet its study has been very difficult due to the variables involved. One of these factors causing inaccuracies in design calculations is termed "compressibility" of the cake. Methods of measuring this factor by means of other and shorter experimental runs have been developed The "compression" period of a sedimentation determination shows a direct correlation with the "compressibility" of the cake as determined by filtration experiments This procedure is now being refined and standardized A quicker and easier method of determining the filtration characteristics of a given sludge has resulted.

Visual fluid-flow meters have been coming into more general use for some years. All use the tapered-wall tube, which is covered by patents. Several types of reliable straight-walled visual fluid-flow meters have been developed by the writer in our laboratories. Using a wide range of materials of construction, they can be made to measure the flow of almost any quantity of any material.

These are but a few of the projects under investigation. Others include the extraction of certain organic materials, the design of circular weirs, flow of fluids through small openings, heat transfer through organic vapor films on both vertical and horizontal tubes, heat transfer by radiation, the use of all-aluminum distillation columns, certain aspects of the settling of fine particles, the use of supersonic frequencies, the extraction of soya bean oil and the recovery of cerium from certain ores.

One of the reasons for the rapid development of the science of chemical engineering in the United States has been the willingness of the colleges to help industry solve its problems. The chemical engineering department at Armour has given such service for over thirty years and will continue to do so in the future. Such problems have formed the basis and the starting point for the fundamental contributions which have been made to the art and science of the fastest growing of the major branches of engineering.

ENGINEERING DEFENSE TRAINING AT ILLINOIS INSTITUTE OF TECHNOLOGY

By

JOHN I. YELLOTT

Like many defense activities, the Engineering Defense Training Program began suddenly, developed in unexpected directions, and grew to proportions which were not contemplated during the early stages. In early November, the Program was suggested to the department heads by President Heald. By the second Thanksgiving Day, Preliminary Proposals for sixteen courses were on their way to Washington. Just before the Christmas holidays, these proposals returned, duly approved, and the real task of organization began. Within three more weeks, five thousand applicants were interviewed, fifteen hundred were assigned to sixty sections of the original sixteen courses, and sixty instructors were drafted from industry. Into the already crowded evening schedules of the Armour and Lewis plants, some fourteen hundred more students were pressed. Illinois Institute of Technology had answered the call of the National Defense Program by putting on a second shift!

Nationally, the Engineering Defense Training Program dates back to the summer of 1940, when a committee of well-known engineering educators was formed to advise the U. S. Office of Education in matters relating to engineering training. Headed by Dean A. A. Potter, of Purdue University, this committee drew the nation's attention to the impending shortage of engineers. It was made known that all of the engineering colleges in the country, one hundred and eighteen in number, graduated only a total of twelve thousand young engineers each year, while an immediate need existed for three times this number. A program of intensive training, on the college level, was suggested, with the expectation of raising, as soon and as far as possible, the efficiency of the engineering forces of the defense industries. No detailed plans for the training were proposed, for it was realized that the needs of different districts differed widely. Evening instruction was seen to be the natural field of the metropolitan institution, while full-time, short-term courses were contemplated for schools located far from industrial districts. Shortages in production engineers, tool and fixture designers, inspectors, and explosives experts, were particularly evident, and it was suggested that efforts be made to meet these demands. Most important, Congress was induced to authorize the expenditure of $9,000,000, through the Office of Education, to pay the costs of the Program.

To administer the Program, Dean Roy A. Seaton of Kansas State was called to Washington as national Director; Regional Advisers were appointed to supervise the work in the several districts into which the nation was divided. President Heald was asked to serve as Adviser for the Chicago area, which includes Illinois and southern Wisconsin.

After conferences with other engineering institutions in the Chicago area, it became evident that the Program here would be organized by Illinois Institute of Technology, and Prof. J. B. Finnegan was designated by President Heald to act as the director. The problems to be solved immediately included the determination of the engineering training needs of this area, the location of space and equipment which could be used in meeting these needs, and the engaging of qualified instructors to give the courses. Preliminary Proposals had to be in Washington by Nov. 25, so that the funds to finance the program could be set aside.

Partial answers to the pressing questions of what courses, where, when, and by whom were obtained by meetings with groups of leading industrialists. All of these men recognized the need for training, many proposed possible courses, and some suggested members of their forces as possible instructors.

Other answers were obtained by faculty members who visited many of the leading plants in the defense industries, and questioned personnel men, chief engineers, and presidents. At about this time, the newspapers began to mention the possibility of free engineering training, and Professor Finnegan found himself besieged by eager applicants for courses which were still non-existent.

After measuring the demand as well as possible, Profesor Finnegan forwarded to Washington, just before the deadline, proposals for sixteen courses, ranging from Elementary Machine Design to Bomb-proof Shelters. Several sections of each course were proposed, and the specifications of each were made as general as possible so that their course content could be altered to meet the demand.

Some of the enrollees in the institute's first engineering defense training program as they made formal enrollment for 60 sections of 16 courses designed to assist industry to meet its personnel demands for defense. Noticeable in the foreground are Professors Peebles, Winston and Huntley. Upper left is Dean L. E. Grinter.

Through the very effective efforts of Mr. Schreiber and his Public Relations Department, the program was publicized by posters, mail, and press releases. The response was immediate and overwhelming. Where tens of applicants were expected, hundreds appeared, and registration forms had to be ordered by the thousand. Every available member of the faculty was pressed into service in interviewing the eager applicants, and the Auditorium of the Student Union had to be taken over to accommodate the crowds.

Professor Finnegan was forced by ill health to relinquish the job of organizing the program, and Professor Yellott was appointed Acting Director. After taking a look at the thousands of application which were pouring in, he immediately obtained the assistance of every available faculty member, and a staff of three secretaries to cope with the flood of prospective students.

The problem of classroom space was solved by taking over every available room which was not in use in the regular night school, on both the Armour and the Lewis Campuses. Many sections were scheduled for Wednesday evening and Saturday afternoon meetings, when the regular activities of the Institute relax somewhat. Classes were put into every available room, and more students appeared where many were already at work.

The task of engaging suitable in-

structors was difficult at the outset, but was progressively simplified by the exceptional cooperation of the many cooperating companies. Appeals were made, and very successfully, to leading companies such as International Harvester, Western Electric, Bell and Howell, Goodman Manufacturing Co. As one instructor accepted the appointment, he was urged to bring in others whom he considered equally well qualified, with the happy result that a staff of sixty able individuals was quickly assembled.

In the fields of Tool Design and Production Planning, the assistance of A. H. Brown, A. I. T. '15, E.E., is gratefully acknowledged. Not only did he agree to teach one section of Production Planning, but he delivered en masse a complete force of tool designers and most of the other production planners.

In Elementary Machine Design, Paul Carlstone, A. I. T. '33, M.E., director of training at the McCormicl works of the International Harvester volunteered his services, and, in co operation with Professor Seegrist, or ganized this course. Other Armou Alumni who are instructing in thi group are R. A. Bartusek, '40, M.E. and R. J. Erisman, '40, M.E., of th Armour Research Foundation.

Once more, International Harves ter supplied the instructors when th course in Industrial Management Foreman Training, was organized. R

Enrolling future industrial managers. Left to right: A. H. Brown and E. A. Nelson, International Harvester Company, A. W. Seward, Clearing Machinery Company, and Knute Peterson, Bell & Howell Company, supervisory experts loaned to the Institute for the engineering defense training program.

3. Starr, Purdue, '34, M.E., underook the responsibility of heading this nportant group, and he enlisted the ther instructors, twelve in number, who are giving instruction in this ourse in Chicago at Lewis, Armour, Revere Copper and Brass Co., Miehle Printing Press Co., Diamond-T Motor Co., and in Waukegan at the American Steel & Wire Co., the Navy Y. M. C. A., the Public Library, and he Greenwood School.

Professor Huntly carried the urden of organizing the work in inpection, and in this field J. E. Harington, A. I. T. '26, Ch.E., is giving course in A. S. T. M. Testing Methds while R. J. Dombrow, A. I. T. '33 E.E., is giving Ordnance Inspection Methods.

The work in Diesel Engineering is being supervised by Professor Roesch. Members of this group are confined o the employees of a particular company which is engaged in the manuacture of large quantities of a new ype of Diesel engine, for use in anks.

Lack of space forbids the listing of he entire group of instructors, but the chedule shows wide spread over inlustry and exceptional educational background and subsequent experience. The Engineering Defense Training Committee takes this opporunity to thank each of the instructors or his cooperation in making the Program a success.

The courses were launched on Janary 6, an eventful evening during which most of the fifteen hundred whose applications were accepted pushed into the Auditorium of the Student Union to enroll, and obtain heir section assignments. The illusrations which accompany these words convey quite clearly the idea of the crowd which stormed the Union, and all but overwhelmed the enrollers. The active members of Pi Tau Sigma served very efficiently as ushers durng this process, and their efforts are gratefully acknowledged.

Most of the courses began during he week of January 15, and remarkable to relate, most of the students and instructors managed to find their separate ways into the proper classrooms. The inevitable conflicts and misunderstandings were relatively few, considering the haste with which he program was authorized. The apologies and regrets of the EDT Committee are hereby extended to hose who were inconvenienced.

Three-quarters of the applicants could not be placed in the classes, because places were available for only fifteen hundred students. To each applicant who could not be accepted, a notice was sent, which listed the reasons for this fact. Many applicants lacked the qualifications while many had already taken college work which went beyond that offered in the Program. The ultimate factor, which determined whether an applicant could be taken, was the consideration of his individual case to see whether his training would aid the National Defense Program.

The administration of an educational institution with fifteen hundred students is not a matter for the parttime efforts of a department head whose activity should be directed towards his particular responsibilities. For this reason, Dr. Fred A. Rogers, who served Lewis Institute for 40 years as the Dean of Engineering, was recalled to active service and appointed Director of the Program. He is in charge of the operation of the existing courses, and the weighty responsibility of filling out the numerous reports to Washington is his. As an added attraction, he is also administering the National Defense Train-

Microscopic crystal structure study of steel.
Engineering defense training program.

The Guiberson Rotary Diesel has specific application in the United States Army's new high-speed light-weight tank. A student in the engineering defense training program is shown making precise measurements of a Guiberson crankshaft.

ing Program, which is giving vocational training in Machine Shop and Welding at Lewis Institute. The general direction of the Engiering Defense Training Program lies in the EDT Committee, composed of Dean Grinter, Dr. Rogers, Professors Huntly and Yellott, and Mr. Spaeth, the Business Manager of the Institute. Other faculty members who exercise supervision of portions of the Program are Professors J. S. Kozacka, Tool Design, W. H. Seegrist, Elementary Machine Design, Mr. A. E. Flanigan, Welding Engineering, and Professor A. H. Carpenter, Metallurgy and Metallography.

As the Engineer goes to press, a second EDT Program is being arranged. No details are available as yet, except that the courses will again be on the college level, devoted mainly to elementary chemical, civil, electrical, and mechanical engineering and to industrial management. The courses will start about March 24, and ample notice will be given through the public press.

THE MUSICAL CLUBS

By
GORDON ERICKSON

Hundreds of graduates who gav of their valuable time while in schoo may be wondering if the present gle club and orchestra compare favorabl with the earlier outfits to which the belonged. Naturally, it is difficul to equal the fine work done in the past but we are still alive and no argumen will convince the men we have thi season that they are not the outstand ing club of all time. Conceit? No just the natural feeling of a group o men who are confident that the possess the ability to sell themselve musically to any audience.

What a pleasure for a conductor t have men who are not only proud o the school they attend but who con sider it an honor to belong to an or ganization that is presenting th school to the public through th twenty or more engagements whic they will fill this season.

An activity that has the interes and enthusiasm of ten per cent of th student body must command the at tention of authorities who pass on th adoption of the extra-curricular pro grams. This department attribute much of its success to the loyal sup port of the president and his asso ciates as well as the student body a a whole. The publications give ampl space and are more than willing to an nounce and cover all engagements.

To the alumni in cities of the mid west we wish to make an appeal fo the clubs. It has been said that a col lege musical organization is as goo as the mileage it covers. Our club have been limited to only a few out of-town engagements. This is due t the fact that no alumni association i any city has considered presenting th I. I. T. musical clubs before influen tial business groups because of th expense involved in transportation o one hundred men. There are severa ways of distributing this expense however, as our programs appeal t high schools, churches, and musica clubs, and our men do not object t playing two engagements in one day

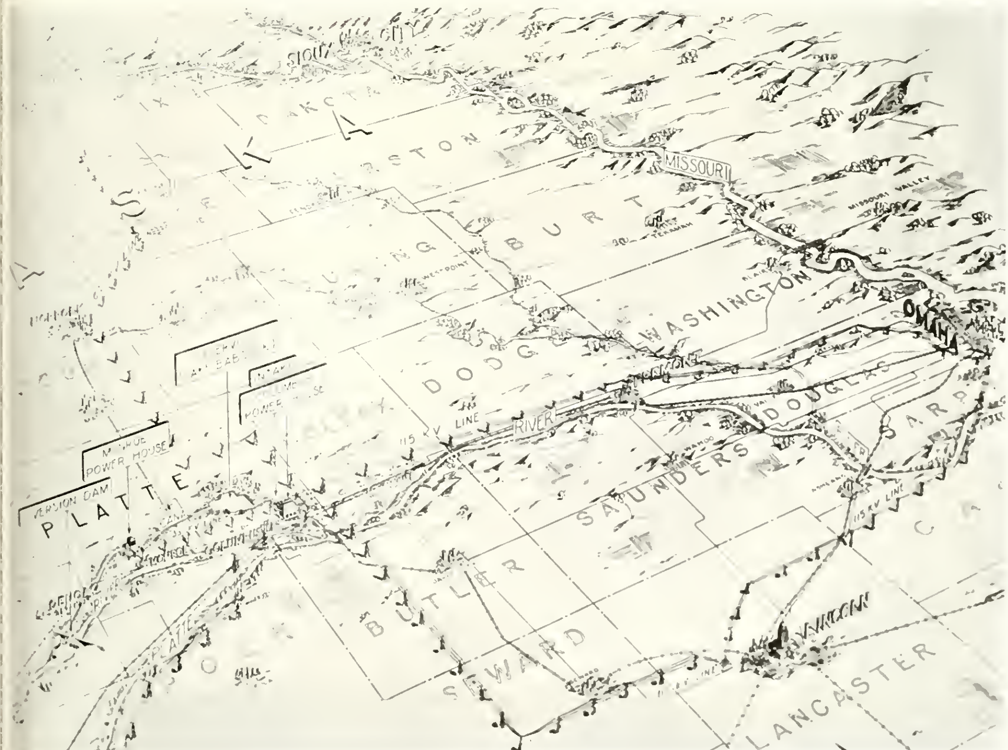
Kindly check your city and com municate with us, as we are open t any reasonable proposal.

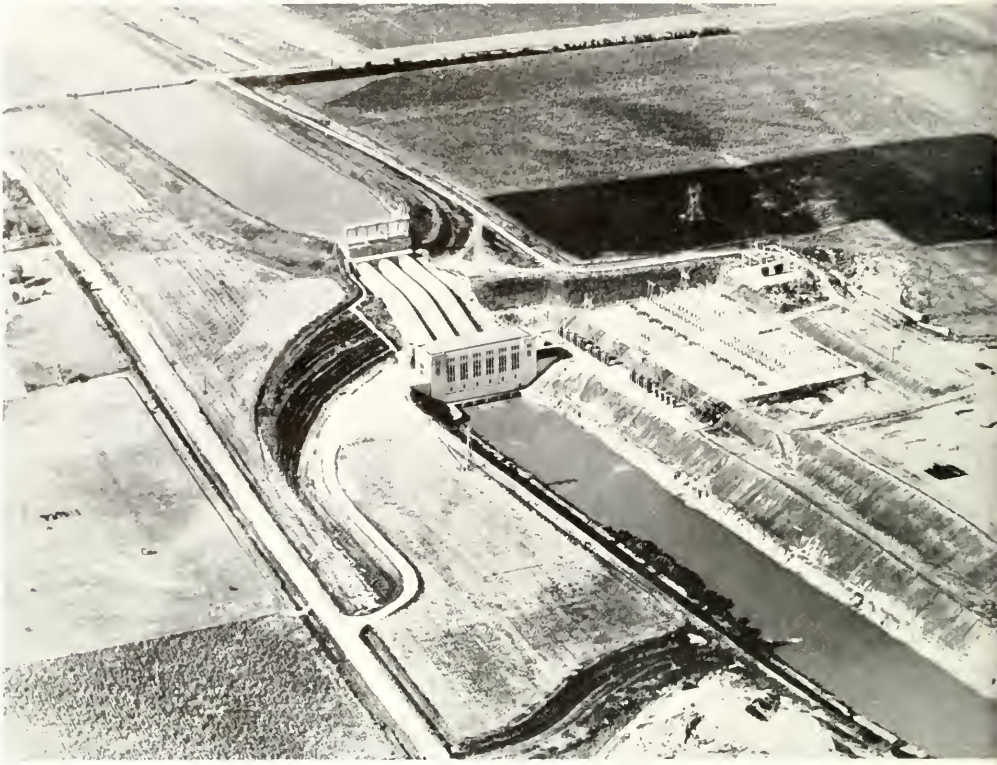
LOUP RIVER PUBLIC POWER DISTRICT

By
GEORGE W. PETERSEN

In and near the City of Columbus, Nebraska, the word POWER had been discussed, principally by Mr. H. E. Babcock, since back in the seventies. Many had tried to develop a project, but all hopes were abandoned when the World War started in 1914.

An Armour alumnus, Mr. Phil Hockenberger (M. E. 1915), born and raised in Columbus, revived the power idea in September, 1932. Because of widespread unemployment and because he believed this to be a project worth while to the vicinity and to the State, Mr. Hockenberger called a meeting of the leading business and professional men of Columbus to discuss its possibilities, with the idea of financing it through the Reconstruction Finance Corporation. All those attending were much interested and a temporary committee was formed. The committee, with the assistance of the business men of Columbus and vicinity, raised $12,000 which was to be used for the purpose of obtaining data and to cover prelim-





Air View of Columbus Powerhouse

inary expenses necessary to submit an application to the Reconstruction Finance Corporation.

In 1933 the committee, together with a group from Lincoln County in Western Nebraska, sponsored and secured passage of Senate File 310, the enabling act, under which a district could be created. This act was approved by Governor Charles Bryan on April 18, 1933. Immediately following this, petitions were circulated and signed by more than fifteen per cent of the voters in Platte County, thereby creating the Loup River Public Power District. This district was to be under the management of an eleven-man Board of Directors, with Mr. Charles B. Fricke, a Columbus druggist, as its first president. The petition was approved by the State Engineer and thus the Loup River Public Power District was made a political subdivision of the State of Nebraska.

Soon after the district was organized, the Federal Emergency Administration of Public Works Act was passed by Congress. The Board of Directors decided to transfer the application from the Reconstruction Finance Corporation to the newly organized Federal Emergency Administration of Public Works in order to obtain a loan and grant, on the basis of seventy per cent loan and thirty per cent grant. The district's attorneys, Wagner and McElfresh, together with Arthur Mullen of Omaha and Washington, prepared the application and submitted it. The money was allocated for this project on November 15, 1933.

Water power rights were obtained from the State on March 23, 1934, fo the diversion of water from the Lou River. The Harza Engineering Com pany, headed by Mr. L. F. Harza o Chicago, were selected as consultin engineers.

Hydro-System

The hydro development consists o a diversion dam, a settling basi thirty-three and one-half miles o canal, a regulating reservoir, and tw power houses. The water elevation a the Loup River intake is 1572 and a the Platte outlet is 1410.

At the headworks, earth dikes wer built on both sides of the Loup Rive to keep the river in one location. Th control weir and intake serve to di vert the water from the Loup River

The weir is a low wall of reinforced concrete, 1320 feet long, extending across the Loup River. The crest elevation is 1574, about two feet above the normal water level of the river at this point. Located on the north bank of the river is the intake structure. This structure is built of reinforced concrete and supports eleven hand-operated, radial gates, each twenty-four feet long and with a maximum opening of five feet. The sill elevation of the intake gates is 1569.5. Downstream from and at right angles to the intake are located three hand-operated sluice gates, each twenty feet long, with a maximum opening of six feet. The sill elevation of the sluice gates is 1568.0. Winter operation is insured by an enclosed boiler which supplies steam for thawing all gates.

The diversion from the river flows into the settling basin, which serves as a stilling basin in which the sand and silt carried in the river water is allowed to settle before passing over the skimming weir into the canal. The basin is 200 feet wide and 10,000 feet long with a maximum depth of sixteen feet. The velocity of the water is less than one foot per second. Operating water level is 1572 and the crest of the reinforced concrete skimming weir is 1568. It is designed for a capacity of 3,000 cubic feet per second. Silt and sand deposited in the settling basin are removed by an electrically driven floating dredge. This dredge has a twenty-eight inch centrifugal pump driven by a 1200 horsepower motor. Tests have demonstrated that this equipment can remove 1,200 cubic yards of silt and sand per hour. The discharge is carried through concrete and galvanized iron sludge flumes and deposited at various points along the river bank, where it is carried away by flood waters. Power for the operation of the dredge is supplied through a 33,000-volt transmission line from the District's power house at Monroe.

The water flows in a canal for eleven and one-half miles from the

Where water goes into settling basin from Loup River.
The ice boom keeps the floating ice from clogging the diversion gates in the winter.

Sawtooth weir at entrance of regulating reservoir (Lake Babcock).
Sawtooth arrangement permits three times as much discharge as if the weir were straight across.

skimming weir of the settling basin to the Monroe power house. This canal is designed to carry 3,000 cubic feet of water per second at a velocity of 2.25 feet per second. The canal has a bottom width of seventy-three feet and water depth of 14.3 feet through the upper seven miles where it passes through river bottom lands; in its lower four and one-half miles has a bottom width of thirty-nine feet and a water depth of 19.5 feet. The fall of the canal is uniformly three inches per mile.

The Monroe power house, which is located one mile north of Monroe, Nebraska, is a reinforced concrete building 129 feet long, 39 feet wide and 87 feet high, built across the canal. This building has a red cement tile roof, steel sash, hollow metal doors, and terrazzo floor and base in the generator room. The building is equipped with a twenty-five-ton electric crane for handling machinery and equipment; it is operated by pendant controls from the generator floor. The Monroe power house has three vertical-shaft Francis turbines of 3,200 horse-power each, directly connected to generators rated at 2750 KVA at ninety-five percent power factor. Governors are of the vertical actuator type located on the floor beside the generators. A one-shot centralized lubrication system is installed on each water wheel to lubricate the gate-stem bearings, gate shifting ring, and gate links.

The generators are connected to a indoor 6900-volt bus. The station ou put is stepped up to 34.5 KV f transmission to the Columbus pla through a bank of three single phas 2500-KVA, 6.9/34.5-KV delta st connected transformers. The norm operating head is thirty-two feet. T Monroe plant is equipped for remo control from the Columbus plant. T Monroe tailwater flows through canal for thirteen miles to the reg lating reservoir; the canal is thirt nine feet wide at the bottom with maximum water depth of 19.5 fe and is designed for the same capaci and velocity as the canal above t Monroe power house.

The regulating reservoir, known Lake Babcock, is located three mil

north of Columbus, Nebraska. It covers an area of 1,000 acres, and at maximum water level has a total capacity of 11,000 acre-feet, of which 5,000 acre-feet is effective for the generation of power. Approximately one and one-half miles of concrete wave-breakers are built for protection of high embankments, and lower fills are protected by gravel riprap. The purpose of this reservoir is to provide storage in order to meet daily fluctuations in demand for power.

The supply canal connecting the reservoir with the Columbus power house is designed to carry sufficient water to maintain all turbines operating at the Columbus plant under full load. This canal is one and one-half miles long; it has a bottom width of 100 feet and normal water depth of twenty-two feet; the velocity of flow varies from 1.4 to 2.0 feet per second; the capacity is 4,800 cubic feet per second.

The Columbus plant consists of an intake structure built at the end of the supply canal, the penstocks, and the power house. The intake structure, built of reinforced concrete, houses three steel gates controlling the flow into the penstocks. Each gate is twenty feet square: all are of vertical lift type, electrically operated. Steel trash-racks with power rakes are provided in order to catch debris which may be carried in the water. The intake structure is 104 feet wide, 60 feet long, and 40 feet high; surmounting it are the hoist towers, which are 34 feet high. The penstocks, leading from the intake to the scroll cases of the turbines, consist of three riveted-steel pipes 20 feet in diameter and 385 feet long. The penstocks have no intermediate anchors and the upper half of each pipe is exposed while the lower half is embedded in screened gravel. The Columbus power house is located two and one-half miles northeast of the city of Columbus. It is a reinforced concrete building 180 feet long, 57 feet wide and 115 feet high. The building has a red cement-tile roof, steel sash, hollow-metal doors, and terrazzo floor in the generator and control rooms. The building has a 75-ton electrically operated hoist with a 15-ton auxiliary hoist for handling machinery and equipment, both operated by pendant controls from the floor. The Columbus power house has three vertical-shaft Francis turbines of 18,000 horse-power each, directly connected to generators rated at 14,000 KVA at ninety-five percent power factor. Governors are of vertical-actuator type located on the floor next

Columbus Power House. Inside view showing two of the three generators.

to the generators. The normal operating head is 112 feet. A one-shot centralized lubrication system is installed on each wheel to lubricate the gate-stem bearings, gate shifting ring, and gate links. Each generator is connected directly to an indoor 13,800-volt bus. The station output is stepped up to through a bank of three single phase 13.8 115-KV delta-star connected transformers, the main bus and switching being at the 115-KV outdoors. The Columbus power house is a manually operated plant and the Columbus substation is controlled and operated by attendants in the Columbus power house. The Monroe plant is also operated from the Columbus plant by remote control.

The tailrace canal carries the discharge from the Columbus power house a distance of five and one-half miles to the Platte River, about a mile below the mouth of the Loup River. The canal is designed to carry 4,800 cubic feet per second at a velocity of three feet per second. It has a bottom width of 42 feet and a maximum water depth of 18.9 feet. The outlet into the river is controlled by a reinforced concrete weir 700 feet long, the crest of which is fixed at an elevation sufficient to maintain the water seal on the draft tubes of the Columbus Power House.

Drainage conditions along the canal have been met by the construction of collecting ditches and concrete culverts to pass the surface drainage under the canal. The crossing of three important creeks was effected by the construction of reinforced concrete siphons to carry the canal under their beds. Two railroad lines and one state highway were crossed by means of similar siphons.

Bridge construction consists of concrete structures for one state and two national highways, two railroad bridges, one of which is a double-track transcontinental line (Union Pacific), and twenty-four county highway bridges of steel and concrete. Treated timber bridges are used for roads of lesser importance and for private crossings for land owners where required.

Transmission System

The transmission lines and substations were designed by the Loup River Public Power District under the supervision of Mr. D. J. DeBoer, Chief Electrical Engineer. The system consists of a 115 KV, 60-cycle, three-phase transmission line from Columbus to Fremont and Omaha, 115-KV, 60-cycle, three phase transmission line from Columbus to Lincoln, 115-KV, 60-cycle, three-phase

(Turn to page 52)

DISTINGUISHED SERVICE AWARD TO PRESIDENT HEALD

The Junior Association of Commerce of Chicago has shown its understanding of the fact that the affairs of the Illinois Institute of Technology are of major concern to the community. At the same time it has conferred honor on our young and energetic president. At a dinner meeting held at the La Salle Hotel, January 21, 1941, commemorating the twentieth birthday of the Association, Henry Townley Heald was cited for distinguished service "in successful direction of the merger of Armour Institute of Technology and Lewis Institute into the Illinois Institute of Technology." The report of the committee on awards stated that the result of his work was "to give Chicago the largest institution of its kind in the country, thus providing the largest possibilities for cooperation with industry."

President Heald's address in acceptance of the award follows:

"I am totally without experience in making speeches of acceptance on occasions of this kind, but I do want to say to the Junior Association of Commerce that I am really appreciative of the honor that has come my way. This gratitude stems not so much from any personal pride which I may have in my own modest accomplishments as from the satisfaction which it gives me to have your organization recognize what seems to me to be a really significant event in educational development in Chicago.

"I understand that this Award was based upon the successful completion

(Turn to page 52)

HELP! HELP! HELP!

ENGINEERING STUDENTS 1940-1941

The Placement Department needs engineers for jobs! You Armour and Lewis Alumni, if you desire a change, or if you are out of work, now is your chance. Engineers are wanted by the thousands! Gone are the days of Technocracy. The golden days of "milk and honey" are here for the engineers. Industry after industry asks for 10, 20, 50, or 500 men, and, yes, one large corporation wanted 3600 engineers at one fell swoop.

From a tireless crumb-picker this department has blossomed into a bloated job dispenser. What have you to sell in the way of experience? Send your story here from wherever you are located. Engineers are wanted all over the United States and abroad. We now have a request for twenty-five men to go to Liberia.

Ever since October, the 1941 class has been interviewed by industrial organizations. Recently, in one week, eighteen different industries granted over 300 interviews to members of our 1941 June graduating class. Sixty co-ops in mechanical engineering who graduated recently were at work the next day.

Salesmen, draftsmen, men for experimental work, men for research, men to supervise employees, men for time and motion study, wage incentive, industrial relations, structural steel designers, highway engineers, tool designers, inspectors—the jobs for you engineers run the whole gamut of engineering experience. Mechanicals, Civils, Architects, Electricals, Chemists, and Chemical Engineers, and men from the department of Fire Protection Engineering are sought.

The Army and the Navy are also asking for numerous men with technical experience for inspection, testing, and research.

At this writing, February 21, 1941, the Navy wants post haste forty of our seniors, fifty-two juniors, and thirty-six or more graduate students. The Army wants twenty-six inspectors (graduates) from us for a training course, and must have them March 1, at the Rock Island Arsenal. The Ordnance Department is looking for men skilled in industrial engineering, to take charge of plants. This week this department has sent several men to Liberia, one to Puerto Rico, some to California, and some to the Atlantic Coast.

If any of you lads can figure out how you can knock off a chunk of the moon and have a couple of billion tons of it drop conveniently on some far-off land for its obliteration, or figure out how to utilize Uranium 235 and shoot a shell equivalent to a billion tons of TNT across the Atlantic or the Pacific Ocean, or how to bore a hole big enough under 1000 feet of water and fill it with enough explosive to sink some island or a continent, or if you can send bolts of lightning out of a tube across the oceans and shock millions of men, or can do research on machines, airplanes, guns, cannon, explosives, or bullet-proof cloth, Uncle Sam is looking for you. A few thousand scientists and engineers may easily be worth a million soldiers, fully equipped. You are needed not only for research on offensive material, but also to match your wits for the defensive against those achievements of science that would tend to obliterate this nation.

There are hundreds of engineers wanted. Send in your experience or write us for a Placement Record, fill it out and AIRMAIL it to the Placement Office.

John J. Schommer,
Director of Placement.

Mechanical Engineering, in its Feb-
ruary, 1941, issue, quotes from the
December, 1940, number of *The
Journal of Engineering Education*
statistics relating to registration in
engineering courses.

The total 1940-1941 enrollment in
155 institutions in the United States
and Canada is 110,618. Of these, by
far the largest number, 28,609, are
in mechanical-engineering courses.
Enrollments in other engineering
courses are: aeronautical, 3723; agri-
cultural, 864; architectural, 1119
ceramic, 730; chemical, 16,177; civil
11,152; electrical, 15,505; industrial
2142; metallurgical, 2276; mining
2294; and unclassified, 25,727. The
total enrollment in 146 institutions
reporting in 1939 was 105,892 under
graduate engineering students.

Enrolled in these same schools fo
work leading to the master's degre
are 4589 students, and for the doc
tor's degree, 623 students. In grad
uate engineering enrollment, how
ever, mechanical engineering (89
master's, 48 doctor's) is edged ou
by chemical engineering (910 mas
ter's, 237 doctor's), and electrical en
gineering (984 master's, 120 doc
tor's). Other graduate enrollment
are: aeronautical, 130 master's, 2
doctor's; agricultural, 28 master's,
doctor's; architectural, 21 master's,
doctor's; ceramic, 14 master's, 2
doctor's; civil, 603 master's, 66 doc
tor's; industrial, 178 master's, 2 doc
tor's; metallurgical, 216 master's, 4
doctor's; mining, 63 master's, 7 doc
tor's; and unclassified, 556 master'
46 doctor's.

The largest undergraduate enrol
ment is at the Illinois Institute
Technology (formerly Armour Inst
tute and Lewis Institute), 4087. Th

(Turn to page 5

I Was All In... But the Major's "33 to 1"
SAVED THE DAY FOR ME!
HERE'S HOW '33 TO 1' DID THE TRICK
SORRY, MAJOR. CAN'T KEEP OUR APPOINTMENT. BEEN A TOUGH DAY
BOB, A LITTLE REFRESHING'S WHAT YOU NEED. EASE UP. END YOUR DAY RIGHT.
EH ? SAY, WHAT HAVE YOU GOT UP YOUR SLEEVE ?
MAJOR, WHAT'S THIS "33 TO 1" ALL ABOUT ?
"33 TO 1" FOR TWO, MISS YOU KNOW WHAT I MEAN.
IT'S PABST BLUE RIBBON. 33 FINE BREWS BLENDED TO MAKE ONE GREAT BEER—SMOOTHER, TASTIER, ALWAYS THE SAME
THIS IS THE TREAT FOR A TIRED BUSINESS MAN. MAJOR. YOU'VE REALLY SAVED MY DAY !
WISE FELLOW, THE MAJOR! BLENDING 33 BREWS CERTAINLY MAKES ONE DELICIOUS BEER!
Yes, REAL BEER LOVERS know it's *smart* to order Pabst Blue Ribbon. It has something you enjoy in no other beer: a BLEND of 33 fine brews to make *one* single glass! As in the finest coffee and champagne, it's this *expert blending* that gives Blue Ribbon its smoother, tastier, unvarying goodness. Today—treat yourself to a cool, foaming glass—and *prove* it!
Copyright 1941, Pabst Brewing Company, Milwaukee
33 fine brews blended to make ONE great beer!
IT'S SMOOTHER . . . IT'S TASTIER . . . IT NEVER VARIES
Pabst Blue Ribbon
Blended 33 to 1
with a Blue Ribbon on it
PABST BLUE RIBBON BEER
Pabst BLUE RIBBON
Enjoy it in full or club size bottles, handy cans, and on draft at better places everywhere.

MIDWEST POWER CONFERENCE

APRIL 9-10, 1941

PALMER HOUSE, CHICAGO

In the December issue of the Armour Engineer and Alumnus, your attention was called to the fact that the 1941 meeting of the Midwest Power Conference will be held Wednesday and Thursday, April 9-10, at the Palmer House, Chicago. The preliminary program of the Conference has been released recently by the Conference Director, Stanton E. Winston, and is given herewith. An inspection of this program will make it evident that you can not afford to miss this Conference if you are interested in any phase of the field of power. You are most cordially invited, and your presence will be appreciated.

Programs, containing registration cards and complete information concerning the Conference, are now available, and may be obtained from C. A. Nash, Conference Secretary, Illinois Institute of Technology, Chicago, Illinois. Send for several copies and pass them on to those of your acquaintances who will be interested.

Preliminary Program

Wednesday, April 9, 1941

9:00 A.M. Registration.
Palmer House, Chicago.

10:15 A.M. Opening Meeting.
O. A. Leutwiler, Chairman.

(a) Address of Welcome. Philip Harrington, Commissioner of Subways and Superhighways, Chicago, Ill.

(b) Response for the Cooperating Institutions. Huber O. Croft, Head, Department of Mechanical Engineering, The State University of Iowa.

(c) Power Facilities and the Defense Program. C. W. Kellogg, Group Executive, The Advisory Commission to the Council of National Defense.

(d) A Resumé of Present Day Power Trends. A. G. Christie, Professor of Mechanical Engineering, The Johns Hopkins University.

12:15 P.M. Joint Luncheon with A.S.M.E.
L. M. Ellison, Chairman.

Speaker: Alfred Iddles, Application Engineer, Babcock and Wilcox Company, New York.

2:00 P.M. Central Station Practice.
M. P. Cleghorn, Chairman.

(a) Forced Circulation in American Power Plant Practice. W. H. Armacost, Chief Engineer, Superheater and Economizer Division, Combustion Engineering Company, Inc., New York.

(b) Modern Steam Turbine Design. C. C. Franck, Engineer in Charge of Central Station Turbines, Westinghouse Electric and Manufacturing Company, Philadelphia.

(c) Variable Speed Drives for Power Plant Auxiliaries. G. V. Edmonson, District Hydraulic Coupling Specialist, American Blower Corporation, Chicago.

(d) Discussion.

3:45 P.M. Hydro Power.
Ben G. Elliott, Chairman.

(a) Hydro Power and the National Emergency. Roger B. McWhorter, Chief Engineer, Federal Power Commission, Washington, D. C.

(b) The Operation of the Multi-purpose Projects of the Tennessee Valley Authority. Sherman M. Woodward, Chief Water Control Planning Engineer, Tennessee Valley Authority, Knoxville, Tenn.

(c) A paper to be presented by W. J. Rheingans, Test Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

(d) Discussion.

6:45 P.M. "All Engineers" Dinner.
Informal (Ladies invited).

Speaker: Dr. Harvey N. Davis, President, Stevens Institute of Technology.

Thursday, April 10, 1941

9:15 A.M. Electric Power Transmission.
C. Francis Harding, Chairman.

(a) The Limitations Placed on Power Transmission by System Stability. H. E. Wulfing, System Development Engineer, Commonwealth Edison Company, Chicago.

(b) Trends in Equipment Design in Relation to Economics and Defense. W. J. McLachlan, Engineer in Charge of Apparatus Line Sponsor Section, General Electric Company, Schenectady, N. Y.

(c) Discussion.

9:15 A.M. Industrial Power Plants.
Hugh E. Keeler, Chairman.

(a) Increasing Power Production with Present Boiler Facilities. R. S. Hawley, Acting Chairman, Department of Mechanical Engineering, University of Michigan.

(b) Instruments and Control. Charles W. Parsons, Republic Flow Meters Company, Chicago.

(c) Discussion.

10:45 A.M. Feedwater Treatment.
Chairman, H. E. Hollensbe, Editor, Industrial Power.

(a) Removal of Gases from Boiler Feedwater. Arthur E. Kittridge, Chief Engineer, Cochrane Corporation, Philadelphia.

(b) Water Treatment Problems in the Steam Power Plant. Frederik G. Straub, Research Associate Professor of Chemical Engineering, University of Illinois.

(c) Discussion.

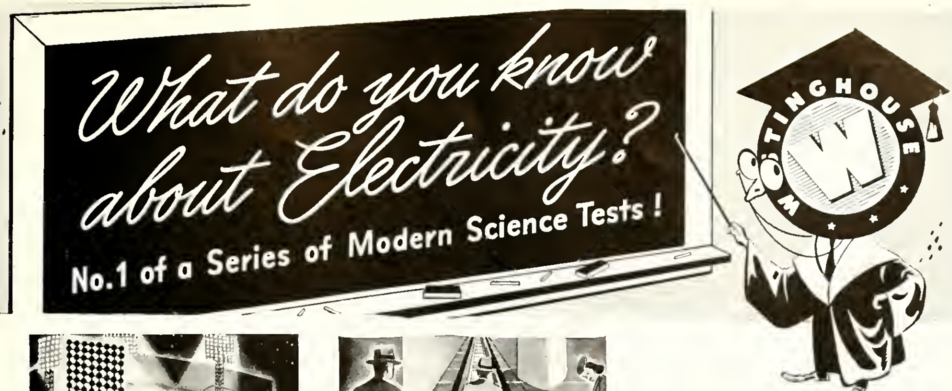
12:15 P.M. Joint Luncheon with A.I.E.E.
Frank V. Smith, Chairman.

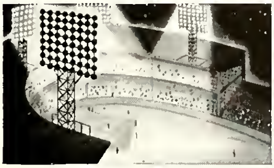
Speaker: Major Charles W. Leihy, F.A., formerly Editor, Electric Light and Power. "Aspects of the National Power Pool, Defensively and Afterwards."

1:45 P.M. Bus leaves Palmer House for Inspection Trip through the Tractor Works of the International Harvester Company.

4:30 P.M. Bus returns to the Palmer House.

8:00 P.M. Smoker—
Final Get together.
Entertainment.





NIGHT BASEBALL

Six major league parks have been equipped by Westinghouse for night baseball. Each of these "8-tower" installations develops approximately the following amount of light:

1. 750,000 Candle power
2. 100,000,000 Candle power
3. 2,575,000 Candle power
4. 210,000,000 Candle power

LONGEST ELECTRIC STAIRWAY

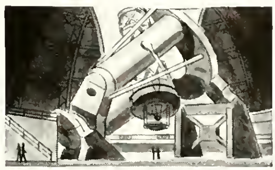
Two years ago Westinghouse engineered and built the longest electric stairway ever used in this country. It was designed to:

1. Save subway riders millions of steps.
2. Transport passengers to the top of the Empire State Building.
3. Carry shoppers from floor to floor in Macy's Department Store.
4. Transport World's Fair visitors to the inside of the Perisphere.

THE STERILAMP

Science has acclaimed the new Sterilamp developed by Westinghouse because:

1. It provides normal daylight for classrooms, offices and factories.
2. It facilitates medical diagnosis of difficult pathological conditions.
3. It kills micro-organisms with ultraviolet radiation.
4. It extends the range of airway beacons.



THE LARGEST TELESCOPE

The 200-inch telescope for which Westinghouse designed and built the mounting is now being erected:

1. On Mt. Palomar, California.
2. On Bear Mountain, New York.
3. On Sankaty Head, Nantucket.
4. On a mountain in Aberdeen-Hoquiam, Washington

THE ATOM SMASHER

The giant 90-ton atom smasher in the Westinghouse Research Laboratories is used principally for:

1. Testing the tensile strength of metal.
2. Measuring the impact of projectiles.
3. Conducting theoretical research in nuclear physics.
4. Providing high-voltage beam for deep X-raying.

THE TIME CAPSULE

The Westinghouse Time Capsule buried on the site of the New York World's Fair contains:

1. Various plans for universal peace.
2. A record of contemporary civilization.
3. Autographs of celebrities who visited the N. Y. World's Fair.
4. A list of the most important electrical inventions of the twentieth century.

Just a Word Before You Begin

Here's an opportunity to test your knowledge of electricity and measure your familiarity with important developments in the field of science.

Optional answers are provided for each of the six situations illustrated at the left. Your task is to select the one that's correct. So that there'll be no temptation to peek, the answers are printed below, upside down.

If you get four out of six correct your knowledge of electricity is average. Five out of six is good. If you chalk up a perfect score the class ought to vote you "most likely to succeed."

★ ANSWERS ★

Night Baseball .... Ans. 4.
Longest Electric Stairway .... Ans. 4.
The Sterilamp .... Ans. 3.
Largest Telescope .... Ans. 1.
The Atom Smasher .... Ans. 3.
The Time Capsule .... Ans. 2.

Westinghouse *"The name that means everything in electricity"*

THE BOOK SHELF

By

PHILIP O'KELLY

CHICAGO SYMPOSIUM

Elder Olson, *The Cock of Heaven:* The Macmillan Company, 1940.

George Steele Seymour, *Hilltop in Michigan:* The Bookfellows, 1940.

Carl H. Grabo, *The Black Butterfly:* Packard and Company, 1940.

The world of letters knows well the Chicago which Carl Sandburg described in blood-red lines:

Hog Butcher for the World,
Tool Maker, Stacker of Wheat,
Player with Railroads and the
 Nation's Freight Handler;
Stormy, husky, brawling,
City of Big Shoulders:

But many-sided Chicago is also a city of poets, three of whom made in 1940 important contributions to American literature. From Elder Olson, Assistant Professor of English at Illinois Institute, came *The Cock of Heaven.* George Steele Seymour, Assistant General Auditor of the Pullman Company and founder of The Bookfellows, completed *Hilltop in Michigan.* Carl H. Grabo, Professor of English at the University of Chicago, brought together the poems of *The Black Butterfly.*

In *The Cock of Heaven*, Professor Olson does not seek to develop an entirely new or original type of book. His basis is a medieval form, the commentary on a given text, that presents a dialectic scheme from which a logically valid conclusion may be drawn. By variation in style and verse form, the author both imitates and makes distinctive the personality and style of the men from whom comments are taken. With one exception, this outstanding piece of writing is original. Here, Professor Olson builds a section from sentences found in the sermons of John Donne. These excerpts he arranged in a sequence which resulted in a flowing prose passage.

Having imitated the style and utilized the ideas, feelings, and beliefs of the Middle Ages, *The Cock of Heaven* may appear morbid to those unacquainted with the period. In any event, gaiety could not be predominant in a text concerned with the history of man in relation to the seven deadly sins. Far from morbid is the conclusion that man was created much too weak for the temptations which beset him, and therefore he may not be damned by an all-merciful God. This carefully drawn and logically valid conclusion, we may add, runs counter to accepted medieval thought, and was challenged by St. Thomas Aquinas, among other authorities.

As a rule, the verse flows freely, and in its various forms repeatedly gives evidence of unusual poetic versatility:

In that land the fixed stone
Cried out for the bird's transit, the
 free bird
Cried out for the establishment of
 stone:
The mountains, for envy of their
 images,
Strained, cracked, lunged, slid into
 the sea;
Meanwhile the impersonal sun lit
 common air;
Fruits shone, or snow, according to
 the season.

. . . . . .

Smite Thou this hollow heart; though
 it lament,
Pity it not: Musician, no wrong
Is suffered by the shaken instrument,
Though mournfulness awake and echo
 long.

O heed it not but take it for Thy bell,
But speechless metal strangely given
 tongue,
That feels no stroke upon its given
 shell,
Whatever cry be of its substance
 wrung.

Never does *The Cock of Heaven* show a lack of polish, although at times polish is subordinated to intensity:

Wind veers, the ship fares
As the moon moving in the sea's
 mountains,
In the formed land the slow foot
 fares.
We stare to sheer sky-rim,
Of our agonies raise there
Running waves, dawn-burst,
Towered rain-ranges, night country;
Never the sought star.

In *Hilltop in Michigan,* George Steele Seymour has wrought an interesting narrative poem of rural life. Presented as a legend, it seeks in part to provide a foundation for additional legends with which time may surround the new library of the Order of Bookfellows—built upon a hilltop in Michigan.

The tale itself is moving and well told, with the rural setting as typical as the people who inhabit the land. We have the author's word that the entire narrative is fictitious, but one feels that Mr. Seymour both knows and has in mind characters similar to those described. Always maintaining his purpose of forming a nucleus legend, he sacrifices everything to the telling of his tale. An excellent storyteller, he adroitly entwines the lives of the people, the local customs, mannerisms, and conditions around the Bookfellow's building. Interest in, and the pace of the narrative are well sustained, but not sufficiently to hide occasional grossness in the verse. Had the whole of the book been upon a lower poetic plane, the lumpy spots would not prove so jarring. As it is, the reader first will rise on the crest of a beautiful descriptive passage:

The farmer sweating at his round,
Hot horses dragging through their
 toil,
The patient cow, the panting hound,
All vassals of the sun. The soil,
Tortured beyond the brink of peace,
Takes vengeance in her ancient way—
The innumerable slow release
Of slender shafts that stab the day.

Next, sweeping down the slope of an engrossing tale:

Then to a boarding house she hied
 her,
Keeping her fortune close beside her.
She chose a room on the second floor,
Making sure of a well-locked door,
Trusting that the door was stout
Enough to keep all comers out.

The reader may be taken up short in a slough of near-doggerel verse:

Every day
His presence graced the entry way.
Seeking to make life most enjoyable,
He'd cast his lot with the Great Unemployable,
And, careless of his fate or dress,

(Turn to page 53)

FORTY-FIFTH COMMENCEMENT

The commencement ceremony, January 29, 1941, at the auditorium of the Museum of Science and Industry, was the forty fifth for Armour College of Engineering, and the first for Illinois Institute of Technology. It was further notable as the first commencement for students in the co operative division of the department of mechanical engineering, and as the first midwinter commencement.

The bachelor's degree was conferred on sixty mechanical engineers, one architect, three chemical engineers, two electrical engineers, and one fire protection engineer.

The commencement address was by Alfred Kauffmann, President of Link Belt Company. Those of us who have attended many graduations are likely to approach each new one with a feeling that it is an occasion of major importance for the young men who are receiving their diplomas, but with an uneasy feeling that the commencement speaker will have difficulty in finding something to say that we have not heard so often as to make it rather lacking in interest. On the whole, we have been fortunate in this regard at Armour commencements. This year we were especially fortunate. Mr. Kauffmann is an engineer and an outstanding industrial executive. The young men to whom he spoke were nearly all mechanical engineers who had been for the five years of their cooperative course in intimate relationship with the production aspect of their profession. Mr. Kauffmann's address was in the nature of an understanding, friendly chat with a group of younger brothers, for whose ability he had respect, and for whose future he had high hopes. His subject was *Opportunities for Technically Trained Men in the Business Battle Ahead.*

THE ENGINEER AND ALUMNUS welcomes our new group of alumni. They have earned their degrees by thorough, conscientious work, in a program differing from that followed by our four year graduates in details of class schedules, but identical with the four year program in scholastic content and in rigor of requirements.

STEEL PIPE for The CITY of CHICAGO

This view shows three sections of the welded steel pipe that was installed over, and adjacent to, the new subway tunnel, replacing certain existing water mains.

These pipe sections, made by the Chicago Bridge and Iron Company, are 38 in. in diameter by 20 ft. long. The longitudinal and circumferential seams are butt-welded while the field joints are made with Dresser couplings. The pipe was coated inside and outside by a special pipe-coating machine and it was then wrapped on the outside to form a protective covering.

It has been found that steel pipe, because of its superior strength and ductility, will resist with adequate safety the stresses resulting from shock, vibration, settlement, or high pressure.

—and now another big

Annual Alumni Banquet

6:00 P. M., Tuesday, May 27, 1941

Knickerbocker Hotel

163 East Walton Place, Chicago

To those who have attended the annual alumni banquet in years past will come happy memories of the few hours association with classmates, professors and friends that the occasion provides.

Another alumni banquet is in the offing A better program, perhaps? A livelier evening, perhaps? New features, perhaps? But never a better time to again meet the old gang you grew up with. Other than that you will be exposed to

1. A menu that includes in rapid order: shrimp cocktail, chicken broth, celery and olives, sizzling filet mignon with french fried onions, fancy spuds, new peas, special salad, toasted wafers, and, not ice cream, but frozen french pastry with coffee. With this as a base, you will be ready to hear

2. A nationally prominent speaker who will expound upon a current topic along with a very, very short report of the goings on at the Institute and in the alumni association. Mixed in with all of this, will be

3. The undergraduate Glee Club and the Institute Orchestra to bring you up-to-date on the songs the current crop of engineers are singing. Then you will be surprised to learn that at no time during the evening will you be expected to have anything but a good time. There will be no solicitation of funds, no collection of dues (unless you wish to pay them), no tipping, for the one cost is two bucks. So while this is fresh in your mind send your check, money order or cold cash for

4. Reservations — The Annual Banquet Committee, Alumni Office, 3300 Federal Street, Chicago.

EUGENE VOITA, ARCH. '25, Banquet Chairman

MAKE YOUR RESERVATION NOW!

FROM YEAR TO YEAR

A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

MAN OF THE MONTH

Raymond Eugene Orton, a member of the class of 1928 in the department of Civil Engineering, receives the nomination for Man of the Month of the Armour Alumni Association in recognition of the publication of his series of articles, "Photoelastic Analysis in Commercial Practice," published in *Machine Design*. The new ideas and developments brought out in Orton's five articles were enthusiastically received by engineers and designers throughout America as evidenced by the large number of reprints requested.

Machine Design gained the honor of first award for "editorial achievement in presenting the best series or editorials published (in this class of magazine) during the twelve months ending July 31, 1940." The award was sponsored by *Industrial Marketing*, and was based on the judgment of a jury of awards which included leading engineers, journalists and advertising executives.

These articles indicated an efficient and commercially useful means of solving stress problems and covered the theory of light and elastic theory as it pertains to photoelastic analysis. A discussion of apparatus, model making, calibration and operation, interpretation and application of analysis, and a discussion of errors, were included.

Orton, for the past two years, has been Chief Engineer, Tool Division, Acme Steel Company, Chicago. For eight years, following graduation from

Armour, he was a member of the engineering staff of the Orton Crane and Shovel Company, conducting work in design, detailing and special purchasing of cranes, shovels, hoists and derricks.

During 1936 and 1937, he was Special Steel Mill Engineer for the maintenance and development of special equipment at the Wisconsin Steel Works, Chicago.

In 1937, Orton began work for the Acme Steel Company in the department for the design and development of hand tools for packaging goods with strip steel bands. After a short period as an assistant engineer, he was promoted to the position of Chief Engineer, which position he holds today.

Other technical papers published by Orton include: "Graphical Analysis of Sections," *Machine Design*, December, 1937; "Stress Relief at Stress Concentrations," *Machine Design*, August, 1940.

In continuing his education, he has studied metallography, and the applications and heat treatment of metals. He is a registered structural engineer, a member of the American Society of Mechanical Engineers and the American Society for Metals.

VOITA ELECTED MANAGER

Eugene Voita, who has been most active in the affairs of the Armour Alumni Association, was recently reelected to the Board of Managers, representing the Classes of 1922-26. He received the degree of Bachelor of Science in Architecture from Armour Institute in 1925 and followed this with specialized study at L'Ecole des Beaux Arts, Fontainebleau, France, in 1929.

Voita was very much interested in architectural competitions and won the following awards: $2,000 first prize in international architectural competition for a more aesthetic design of a typical steel water tower, 1931; sixth prize in an international competition sponsored by Standard Sanitary and Manufacturing Company, Pittsburgh, Pennsylvania, 1930; second prize in the foreign travelling scholarship competition of the Chicago Architectural Club, 1929.

He is now practicing architecture

in his own office, having previously been employed as an architectural designer for Howard Major of New York, Coolidge and Hodgdon, Chicago, and Chester H. Walcott, Chicago.

Gene's hobbies include travelling and collecting works of art from the many countries he has visited. He covered all parts of Europe and Northern Africa in 1929-30, Mexico and Yucatan in 1932, and Hawaii, Japan and China in 1935. Extensive sketching and a study of living conditions with considerable attention to methods of construction were undertaken on these journeys.

He is a member of the Cliff Dwellers, Theta Xi Fraternity, Scarab, and the Theta Xi Club of Chicago. He has been chairman of the Alumni Banquet arrangement committee for several years.

DETROIT ALUMNI

Professor J. B. Finnegan was in Detroit early in January, and took advantage of the chance to meet some of the Armour men who live there. A luncheon meeting was held January fourth at Coffee Dan's Old Madrid Restaurant, a most comfortable and respectable place without any of the raffish features which the name of the proprietor might suggest.

Thirty-seven Armour men attended. Harold S. Ellington, '08, presided, and discussed the rapid growth and excellent prospects of the Institute, announcing that important developments would be made public within a few days. Mr. Ellington, an energetic member of our Board of Trustees, expressed his hope that the Detroit alumni would form a permanent organization. A list of Armour men in Detroit and neighboring cities has been sent to Mr. Ellington, to E. R. Hubbell, '26, and to J. B. Finnegan, Jr., '32, to aid in making plans for the organization.

At the luncheon, Professor Finnegan described present conditions at the Institute, discussing the Lewis merger, the three cooperative courses, the Engineering Defense Training program, the increased attention to student personnel problems, the rapid growth of the evening division and the graduate division, the Research Foundation, and the general atmosphere of confidence and energy apparent throughout the school.

Those present at the meeting were as follows: Ahern, J. J., F.P.E. '35; Alber, L. Dean, F.P.E. '26; Arends, E. W., F.P.E. '32; Arends, John J., F.P.E. '32; Berg, Melvin C., F.P.E. '30; Bray, Don R., F.P.E. '30; Chandler, C. S., F.P.E. '28; Clark, J. T., F.P.E. '28; Corliss, Geo. W., F.P.E. '27; Cottington, Nason, F.P.E. '28; Dunbar, C. W., F.P.E. '38; Ellington, Harold S., C.E. '08.

Finnegan, Jr., J. B., F.P.E. '32; Geisler, R. J., C.E. '12; Glover, J. N., Ch.E. '25; Henry, Jr., Arthur W., F.P.E. '28; Hirt, W. A., E.E. '07; Hubbell, E. R., F.P.E. '26; Jensen, Roy P., M.E. '23; Kesselring, P. H., F.P.E. '31; Kittler, M. J., M.E. '29; Koch, Albert N., M.E. '14; Lukas, M. A., F.P.E. '34; McKarahan, E. V., F.P.E. '09; Maguire, H. B., F.P.E. '17.

Miller, Leo B., F.P.E. '28; Nelson, C. A., F.P.E. '33; Paul, Don J., F.P.E. '30; Reifler, J. J., F.P.E. '28; Sademan, Elmer E., F.P.E. '33; Smethells, W. T., F.P.E. '33; Shur, D. C.; Swinson, H. A.; Vanderpoorten, S. A., F.P.E. '33; Witting, B. A., F.P.E. '29; Wolf, A. M., E.E. '35.

CINCINNATI ALUMNI

Professor Finnegan visited Cincinnati January fourteenth to address a class in fire insurance conducted by Walter H. Alexander, F.P.E. '27, in the evening division of the University of Cincinnati. Regular enrollment in the class is thirty, but this lecture, the last one of the semester, was specially announced to insurance men and the attendance was about one hundred, including several Armour men.

On January fifteenth, Professor Finnegan met nine of our alumni at luncheon at the Netherlands-Plaza Hotel.

TEST PILOT DIES

Lieutenant Paul L. G. Moore, a[n] outstanding graduate of the Civil Engineering Department with the Class of 1937 was instantly killed whe[n] the speedy Airacobra P-39 pursui[t] plane he was piloting crashed from 1000 feet on December 22, 1940. H[e] was detailed to Patterson Field, Dayton, Ohio, to test this type of plane. The accident occurred at the Taylorsville dam which is near the flying field.

Paul Moore, an affable characte[r] to all who knew him, was an athlet[e] of high caliber in addition to bein[g] a scholar. He captained the Armou[r] Boxing Team in 1937 and gave a[n] excellent account of himself in th[e] Golden Gloves bouts that year. Hi[s] scholarship ranked him with the to[p] men in his class and he was re[-]warded with membership in Tau Bet[a] Pi. He took an active interest i[n] school affairs and was always read[y] to lend a hand to a classmate.

After graduation in 1937 he spen[t] a short time with the United State[s] Gypsum Company and later becam[e] a flying cadet in the U. S. Army Ai[r] Corps at Randolph Field, Texas. H[e] was graduated in February, 1939, a[s] the highest ranking cadet. In th[e] same month he was married to Mis[s] Mary Lange of Wichita, Kansas.

Lieutenant Moore was assigned t[o] Selfridge Field, Michigan, and wa[s] stationed at Patterson Field to te[st] fast army planes. This assignmen[t] came because air corps officials re[-]garded Moore as an outstanding pilo[t]. He had always been an aviation en[-]thusiast and considered army flyin[g] a job he had to do. He did not fe[el] that his endurance-testing of high[-]speed planes was a hazardous unde[r]taking.

Reports of the accident indicate that while he was travelling at a high speed a piece flew off the wing tip and hit the plane's stabilizer. The plane fell immediately from an altitude of 1,000 feet after a snap-over roll.

Funeral arrangements were completed in Wichita, Kansas, where the family home was located.

MISSING MEN

At the end of the Alumni Notes for each class in this issue of THE ARMOUR ENGINEER AND ALUMNUS is shown a list of names for which the Alumni Office has no record of business or home address. If you know the whereabouts of any of these men please send any information you may have to the Alumni Office, 3300 Federal Street, Chicago, Illinois.

1897

WHEELER, JOHN JONES, M.E., who is retired, is residing at 857 E. 116th Place, Los Angeles, Cal. He writes that he is out in California taking the sun cure, trying to get the kinks out of his writing hand.

MISSING MEN

SALAMSON, MAX.

1898

MISSING MEN

WEINSHEIMER, WARREN F.

1899

SHUBART, BENEDICT, M.E., passed away in San Diego, California, on September 30, 1940. While in the hospital a frequent visitor was Mr. Shubart's old Mathematics Professor at Armour, Dr. Alderson. He was a partner in the firm, Schubart & Schloss, specializing in machinery and pumping equipment with offices in Denver, Colorado.

MISSING MEN

DE RIMANOCZY, BELA
MORSE, CHARLES SUMNER

1900

HAYDEN, GEORGE FOWLER, E.E., who is Secretary of the Continental Insurance Company, 80 Maiden Lane, New York City, N. Y., is now residing at 57 Union Street, Montclair, New Jersey.

MISSING MEN

FISCHER, CHARLES HENRY
GRAFF, HERMAN WALTER
MARTIN, ROBERT CLOUGHAN
McELDOWNEY, HAROLD BATCHELDER
TOUSLEY, JOHN HENRY

1901

MISSING MEN

ARNOLD, MARK H.
BAKER, EARL HEAD
COHEN, LOUIS
PARKER, JOHN HENRY

1902

MISSING MEN

BAIRD, MANLEY F.
HARWOOD, EDWARD THOMAS
MILLER, IVAN D.
SCHEIDLER, OSCAR
WALLACE, ERNEST LEROY
WEEK, JOHN ELMER

1903

STRICKLER, JOHN FRANKLIN, M.E., who is Secretary of the Jam Handy Picture Service, Inc., 2900 E. Grand Ave., Detroit, Michigan, has recently moved to 67 Eason Ave., Highland Park, Michigan.

MISSING MEN

BABCOCK, FRED RIPLEY
KAEMPFER, ALBERT
QUIEN, ERNEST LOUIS
STEVENS, GRAFTON
STILLSON, HOWARD GEORGE
WEISSKOPF, MAURICE JOSEPH

1904

FRARY, DON READ, E.E., is now in the Marine Insurance Dept. of Forrest L. Haines, 1657 Washington Ave., Miami Beach, Fla., and is residing at 2165 S. W. 10th St., Miami, Fla.

MISSING MEN

KNAPP, MORRIS JASON
NYMAN, MELANCTHON REES
WALLACE, JOHN FINDLAY

1905

MISSING MEN

ASH, HOWARD JOSEPH
BEAMER, BURTON EVANS
McLENNAN, HUGH
STEM, LeVERE H.
THOMPSON, JOHN KRING
TYLER, ALVA WARREN
WRIGHT, MELVILLE EDWIN

1906

35th Year Reunion

Under a Rixy-Ray-Rah-Rix!! Armour Tech-Nought Six!! screaming headline announcement comes news that this class plans to make the Alumni Banquet on May 27, 1941, the greatest reunion they have ever staged. The arrangement committee is headed by co-chairmen Max Woldenberg and David Moreton. Assisting in the preparations are the following: Charley Baker, Walt Leininger, Bob Layer, Gene Hiller, Frank Wanner, Joel Smith, Phil Harrington, Joel Wilson and O. T. Allen. Queries may be directed to the committee at 159 W. Kinzie Street, Chicago, Illinois.

SAMUEL KLEIN, C.E., was instantly killed when he fell from a corridor window of the 16th floor of the Tower Building in Chicago, on December 6, 1940. Mr. Klein had been in ill health for the past two years. He was a prominent consulting engineer. He is survived by his widow, a son, and a daughter.

MISSING MEN

BREMER, HARRY A.
CUTLER, EDWARD WARNER
EDSON, NORMAN L.
MORRISON, RALPH D.
REED, OLIVER ROY
SCOTT, PATRICK JOHN

1907

MISSING MEN

BADGER, LEROY H.
HEINSEN, GEORGE MARTIN
KILGORE, CLARENCE EARLE
PRATT, EDMUND ADDISON
SCHERMERHORN, WILLIAM E.
TURNBULL, IRA JAMES
WHEELER, HARRY McINTYRE
YOUNG, LERTON BURDELL

1908

WILSEY, GROVER H., C.E., who is Chief Engineer, Foley Brothers, Inc., Pleasantville, Ill., has moved to 16 Eldridge Ave., Ossining, N. Y.

MISSING MEN

CAHAN, JAMES
COLLINS, FRANK CAMPBELL
CORNWELL, AUGUSTUS BOOKER
LOOFBOURROW, JOSEPH DAVID
MOREY, CLIVE RIORDAN
SOUTHER, SIDNEY ALGERNON
STARIN, LOUIS DUANE

1909

FRISBIE, HENRY CHARLES, C.E., who is in business for himself at 2438 E. 55th St., Los Angeles, Calif., has recently changed his address to 100 Via Trieste, Newport Beach, Calif.

YOUNGBERG, HARRY W., C.E., who is with the Robins Conveying Belt Co., Passaic, N. J., has moved to 304 Hillside Ave., Nutley, N. J.

MISSING MEN

AHERN, JOHN F.
PERRINE, ARTHUR A. R.
SOPER, ELLIS CLARKE
VACEK, VINCENT FRANK

1910

ELIEL, ROBERT G., C.E., who resides at 1001 N. Main St., Rockford, Illinois, has been incapacitated since 1937 when his eyesight was destroyed because of an operation for the removal of a brain tumor. Members of the Class of 1910 are urged to write to Mr. Eliel and possibly renew old acquaintanceships. He was associated with the Bradley Machinery Co. in Rockford.

McCUNE, SAMUEL W., E.E., who is a Departmental Engineer in the Organic Chemicals Dept., E. I. duPont de Nemours, Wilmington, Del., is residing at 1404 North Bancroft Pkwy., Wilmington, Del.

MISSING MEN

CROCKER, ALBERT HENRY, JR.
GENTRY, TANDY ENOCK
LEAVELL, RICHARD A.
MACEWING, EUGENE DUNCAN
PEARCE, ROSWELL PHELPS
THOMAS, WILLIAM EDWARD
WILLIAMS, DUVALL
YOUNG, DONALD AUGUST

1911

CLEAVER, T. G., C.E., who is Sales Engineer for Carnegie-Illinois Steel Corp., 208 So. LaSalle St., Chicago, has recently changed his address to 423 Kedzie St., Evanston, Ill.

EMIN, GERSON HERBERT, C.E., who is now in business for himself as Sales Engineer, 616 S. Michigan Ave., Chicago, represents some of the outstanding mills in the country. He has recently changed his address to 2918 Pine Grove Avenue, Chicago.

TOBIAS, WILFRED R., C.E., passed away at his home in Los Angeles, California, on Christmas Day of a heart attack. He was a prominent roofing contractor in the Los Angeles and Hollywood area.

MISSING MEN

DA SILVA, CLAUDIO JOSE
DE TAR, DE LOS
DOERING, ROBERT CARL
GRAY, R. LEONARD
GRIFFITHS, FRANCIS HERBERT
PETTIBONE, GERRY D.
SALOMON, MEYER JOSHUA
SCHMIDT, EMIL J.
SCHULTZ, WILLIAM EDWARD

1912

CLARK, RONALD, C.E., who is Regional Director for Europe & Canada for the United States Steel Export Co., 30 Church St., New York City, is residing at 38 Boulder Trail, Bronxville, New York.

MISSING MEN
Birrbaum, Arthur Julius
Curren, Earl Leslie
Enoshita, Toyozo
Hazen, Fred George
Marsh, George Everett
Swanson, William Robert
Turley, Everett Wade
Yoshida, Henry T.

1913

Forbes, Howard P., Arch., who is Special Agent for Insurance Company of North America, 40 Broad St., Boston, Mass., has recently moved to 1558 Mass. Ave., Cambridge, Mass.

Hetzler, J. R., M.E., who is in business for himself as Commercial Photographer at 188 Pipestone St., Benton Harbor, Mich., is now residing at R. R. No. 3, Higman Park, Benton Harbor, Michigan.

Larson, Clifford M., M.E., who is Chief Consulting Engineer, Sinclair Refining Co., 630 Fifth Ave., New York City, has recently built a new home at 55 Taymil Rd., N. Y. C. N. Y.

Rothwell, Richard Foss, C.E., is now retired from business and resides at 927 S. Euclid Avenue, Princeton, Ill.

MISSING MEN
Arp, Walter B.
Bangs, Frederick Theodore
Crow, Ralph Miller
Furay, Connell Joseph
Garrison, Carl William
Lill, Arthur Carl
Moore, Fontenelle Logan
Munn, William Kirk
Schmieman, Oscar N. George
Stanley, Harry Cadet
Watin, Herbert S.

1914

Heritage, Clark C., Ch.E., who is Technical Director of the Wood Conversion Company, Cloquet, Minnesota, may be reached at Box 456, Cloquet, Minnesota.

Shane, James Lynch, Arch., who conducts architectural business, resides at 179 Cottage Hill, Elmhurst.

MISSING MEN
Auer, Philip Fenton
Barr, Allen Westgate
Cooley, Gilbert Stanley
Case, Harry Lewis
Kann, William H.
Kujawski, Edward Stanislaus
Roberts, W. F.
Schmidt, Clarence George
Schoembs, Arthur Frank
Semerak, Alfred W.
Sevin, Irving Mandel
Wright, Joseph Charles

1915

Hook, Leonard D., C.E., who is Associate Construction Engineer, Public Works Dept., U. S. Navy, Naval Air Base, Corpus Christi, Texas, is now residing at 1237 Florida, Corpus Christi, Texas. He is in charge of construction work on outlying field P-2, estimated cost of which is \$3,000,000. Total project covers Main Field, P-1, P-2 and P-3, and acreage is 1650. Total estimated cost is \$28,000,000.

Strain, Harry A., Ch.E., was recently promoted to the position of Director of raw materials, fuel and power for the Carnegie-Illinois Steel Corporation and was transferred to the Pittsburgh Office. His residence until his family moves from Chicago in June, will be the William Penn Hotel, Pittsburgh, Pennsylvania.

Sullivan, Thomas Francis, E.E., passed away in March, 1940 according to information received from Monroe, Mich.

MISSING MEN
Gleason, Charles E.
Hirose, Yoshisakee
Johnson, Victor Emanuel
Kiene, Theodore John
Mammes, Harry Anthony
Mieczkowski, Tadeusz
Pulsifer, Harrie Bridgman
Parrott, Raymond Dunmore
Patterson, William H.
Shaeffer, Sydney
Stark, Andrew Gordon
Wagner, Fred Harry
Wong, Jr Kwum

1916

Abrams, Samuel Neal, E.E., who is Publisher of the American Trade Magazines, Inc., is now residing at the Surf Hotel, 501 Surf Street, Chicago. He has two daughters attending college, one at Colorado College and the other at Frances Shimer Junior College.

Finck, Sidney Copland, Arch., has recently changed his address to 7007 Oglesby Ave., Chicago.

MISSING MEN
Adams, Robert Smyth
Apfelbach, Henry Julius
Armacost, Wilbur H.
Bland, Henry
Broman, John Gustav
Eames, Emerson Rexford
Harris, Harry S.
McHugh, Lawrence John
Miller, Joseph V.
O'Dea, Thomas M.
Volz, William Herman

1917

Andren, Olof Erik Hjalmer, C.E., has recently changed his address to 2310 Peoria Avenue, Peoria, Ill.

Luttge, Harold, M.E., who is Mechanical Engineer, War Dept., St. Louis Ordnance District, 12th & Market St., St. Louis, Mo., is residing at 8760 Rankin, Brentwood, Mo.

Pedersen, Arthur Aksel, C.E., who is Engineer, Oscar Daniels Co., 135 S. LaSalle St., Chicago, has changed his address to Route 2, Box 327, Tampa, Fla.

MISSING MEN
Cooper, Earl Cortland
Haines, Edward Wilfred
Kendall, Sydney Wilmer
King, Laurence Albert
Morse, Ralph Lincoln
Prochazka, Rudolph Vencil
Turner, John William
Vesely, William J.

CLASSIFIED ADVERTISEMENTS

1918

Morrison, John W., F.P.E., who is ːesident Engineer, Curtis Lighting, Inc.. 01 Keith Bldg., Cincinnati, Ohio, is re-ıding at 2558 Madison Road, Cincinnati, ›hio.

MISSING MEN

Andre, Guy Lawrence
Durham, Edward James
Erickson, Raymond Andrew
Kerr, Volney Applebee
Vogdes, Francis Brooke

1919

Muesse, Howard S., Arch., is in the rchitectural business at 710 American ßldg., Cincinnati, O.

Trask, Frederic Allan, F.P.E., who is n Engineer for the Oil Insurance As-›ciation, 175 W. Jackson Blvd., Chicago, as recently moved to 1570 Oak Street, ːvanston, Illinois.

MISSING MEN

Boetter, Carl Louis
Cowles, Frank Spencer
Dady, William Eugene
Geldmeier, Henry Frederick
Gold, Carl Lewis
Schimek, Alfred Fisher
Senescall, Clyde
Wallace, Maurice Roy

1920

Hall, Thomas Winslow, M.E., who is ıssistant Advertising Manager for the ːarborundum Company, Niagara Falls, ;. Y., has recently moved to East River ßoad, Grand Island, N. Y.

MISSING MEN

Bloomberg, Sheldon
Fainstein, Morris
O'Connor, William Joseph
Podolsky, David Henry
Popkin, Jacob
Sabiston, Kenneth M.
Schwartz, Frank H.
Smely, James
Wong, Yuk Man

1921

Naiman, Julius M., M.E., who is the wner of Julius M. Naiman Co., Consult-ıg Engineers, 600 S. Michigan Ave., Chi-ago, has recently changed his address to 029 N. St. Louis, Chicago.

Walter, Charles Taylor, M.E., who is)evelopment Engineer in charge of ːquipment, Development Department, ›wift & Co., U. S. Yards, Chicago, has hanged his address to 6700 Crandon Ave., ːhicago.

MISSING MEN

Anderson, Fred B. A.
Appelbaum, Abraham
Bloom, Louis Simeon
Browde, Aaron M.
Henion, Henry M.
Kaplon, Hilton
Mundt, Edward
Muramoto, David K.
Pierce, William Westrup
Rudd, Eugene Bernard
Zahrobsky, George Joseph

1922

May, Maxwell F., M.E., is Vice Presi-ːent, Catalog Products Division, Young ßadiator Co., Racine, Wisconsin. He is till residing in Palos Park, Ill.

Michels, Thomas, C.E., who is Struc-ural Engineer for the City of Chicago. ıas recently moved to 2905 Pearl St., ːranklin Park, Ill. He is attending Illi-ıois Tech nights for his M.S. Degree. ːhis is his third year of night school.

Trowbridge, Walter S., M.E., who is ːecretary of the Bemis Manufacturing Co. n Sheboygan Falls, Wisconsin, is fortun-ːte survivor of an accident which occured n 1938. With two other men he was ːrapped in a dust bin while attempting to ːxtinguish a fire that had gained little

headway. One of the men perished as the fire got out of control but Trowbridge who was afire at the time thought to jump into an adjoining bin. He was on the verge of life and death for some time and after nine months in the hospital was released. Except for scars there is little to remind him of his harrowing experience. His chief interests are his wife, three boys, and boating on Wisconsin's rivers in the Summer time.

MISSING MEN

Bissel, Woodbridge
Eifrdam, Elmer Conrad
Eisenstien, Samuel
Erlandson, Nels Harold
Gambal, John J.
Georgevick, Elias
Herman, Boris Solomon
Mason, Elmer Bartels
McCormack, William Joseph
Paque, Walter William
Silverberg, S.
Vaaler, John Christian E.

1923

Blair, George Graham, F.P.E., who is an Engineer for Johnson & Higgins, 63 Wall St., New York City, has changed his address to 16710 Crockeran Avenue, Flushing, L. I., N. Y. He reports that on tours of inspection, he travels from Maine to Florida and Wyoming to New Mexico.

Frink, Charles S., C.E., is Purchasing Agent for the Dow Chemical Co., Freeport, Texas, and resides at 1517 West 2nd Street, Freeport, Texas.

Jensen, Roy Paul, M.E., is Special Agent for Fireman's Fund Insurance Co., 1621-25 Dime Bldg., Detroit, Mich., and has changed his address to 13265 Ilene, Detroit, Mich.

Smith, Ormas G., C.E., who is Engineer of Buildings, Chicago Area, Illinois Bell Telephone Co., 208 W. Washington St., has changed his address to 770 Oak Grove Ave., Highland Park, Ill.

Temple, Robert A., E.E., who is Superintendent of the South Chicago Plant, Marblehead Lime Company, 3245 E. 103rd Street, resides at 7147 Jeffery Avenue, Chicago.

Worley, John Clark, F.P.E., who is a Consultant, 1230 Empire State Bldg., N. Y. C., has changed his address to 73-12 35th Ave., Jackson Heights, N. Y. Apt. F-63.

MISSING MEN

Clark, Andrew Stewart
Crane, George D.
Dolesh, Frank James
Downs, Fred Caden
Goldstein, Alexender
Graicunas, Vituatus A.
Miller, Douglas F.
Oboler, Max O.
Price, Myron Hawley
Schwartz, Max Leonard
Sloan, Fred E.
Sommers, Louis Henry

1924

Bennett, Percival A., E.E., passe away on July 27, 1940 at the Universi of Chicago Hospital.

Campbell, Richard Blake, C.E., wh is Superintendent of the Leonard Co struction Co., 37 S. Wabash Ave., Chicag resides at 1240 Gregory Ave., Wilmett

Citta, Jerry, Ch.E., who is Inspector the Automatic Sprinkler Dept. of the Il nois Inspection Bureau, 911 Myers Bld Springfield, Ill. has moved to 1314 We Iles Ave., Springfield, Illinois. He married and has two children.

Greenfield, Theodore, Ch.E., who Technical Sales Representative, Velsic Corp., Chicago, has recently changed h address to 1711 Portman Ave., Cincinna Ohio.

Hanson, Everett Hart, ChE., who Chief Industrial Engineer for Standa Oil Co. of Indiana, Whiting, Ind., h recently changed his address to 9822 Sou Hoyne Avenue, Chicago.

Henrikson, Karl E., who is Engine in charge of Laboratory, Link Belt C 519 N. Holmes Ave., Indianapolis, In has recently moved to 4480 Marcy La Indianapolis, Indiana.

Keene, Clair L., E.E., is an Engine for the Mutual Boiler Insurance Co pany, 60 Batterymarch St., Boston, Mas and is living at 10 Lawndale Road, Ea Milton, Mass.

Kinsman, George Chandler, M.E., who
Director of Research for the Florida
wer & Light Co., Miami, Fla., has
cently moved to 1515 Country Club
ado, Coral Gables, Florida.

Lowe, Rudolph P., M.E., who is Vice
esident and Chief Engineer of Pro-
rtioneers, Inc., 9 Codding Street, Provi-
nce, R. I., has recently changed his
dress to 3180 Pawtucket Avenue, River-
e, R. I.

Miessler, Edmund J., F.P.E., who is
perintendent, Lima Branch, Ohio In-
ection Bureau, 1019 National Bank
ilding, Lima, Ohio, changed his ad-
ess to 411 S. Main St., Columbus Grove,
io.

Veggeberg, Julian M., M.E., who is a
nior Mechanical Engineer, City of Chi-
go, Bureau of Engineering, 811 N.
chigan Ave., Chicago, has recently
ved to 1807 North Rutherford Avenue,
icago.

Vorsheim, Henry George, Jr., Ch.E.,
cepted call as pastor of the Westminster
esbyterian Church, 58th and Chester
e., Philadelphia, Pa. It is understood
s is one of the outstanding churches
Philadelphia. His home address is 5820
hitby Avenue, Philadelphia, Pa.

Wells, Edward Lewis, who is Technical
sistant to General Service Manager,
ontgomery Ward & Co., 619 W. Chicago
e., Chicago, Ill., is residing at 4134 N.
ystone Ave., Chicago.

MISSING MEN

Anderson, Harold Edward
Bacal, Harry S.
Baim, Eugene Edward
Bensinger, Eugene A.
Burkey, Mack Garrett
Collins, Chas. M.
Falconer, John Willard
Gaylor, William Sparks
Hart, Thomas Henry
Johnson, Elmer A.
Kautz, Clarence F.
Lipsky, William Saul
Murner, Herbert Kenneth
Nelson, Carl August
Olson, Alden T.
Samuels, Saul
Unger, A. Pat
Vickers, William H.
Walsh, John Leo

1925

Meyer, Edwin Maxwell, E.E., is Chief
gineer for Victor Insulators, Inc.,
ctor, N. Y. He resides at 55 Elm Drive,
chester, N. Y.

Weinwurm, Walter Henry, Ch.E., who
Metallurgist, Union Special Machine
., 400 N. Franklin St., Chicago, has
anged his address to 7304 Lunt Ave.,
icago.

Whitcombe, Earle S., F.P.E., was
med Assistant Western Manager of the
rtford Fire Insurance Co. in a recent
nouncement. He was formerly Assist-
t Superintendent of the Marine Dept.
d before that Special Agent and Engi-
r for the same Company. After gradu-
on from Armour he joined the staff
the Illinois Inspection Bureau and
en he left in 1930 he was Office Man-
r. Residence is 822 S. 18th, May-
od, Illinois.

MISSING MEN

Beck, Mortimer Devine
Gaylord, Robert Paul
Greenleaf, John Simon
Johnson, John Godfrey
McFael, Donald J.
Nudelman, Charles S.
Prendergast, Richard Ward
Shoemaker, John Maxwell
Willey, Samuel R.

1926

Barger, Charles Work, F.P.E., who is State Agent for the Gulf Insurance Co., 706 Chamber of Commerce Bldg., Indianapolis, Ind., is now residing at 3901 Park Ave., Indianapolis, Ind.

Harris, Henry McClellan, F.P.E., who is a partner of McCaslin & Harris, 629 S. Spring St., Los Angeles, Cal., and who resides at 1169 Amalfi Drive, Pacific Palisades, Cal., reports that he and his wife just completed a six weeks aviation trip thru Mexico, Central America, Cuba and East Coast, combining business and pleasure.

Hubbell, Earl Raymond, F.P.E., who is Regional Manager, Royal-Liverpool Groups, 1421 National Bank Bldg., Detroit, Mich., is residing at 2016 Elmhurst Ave., Royal Oak, Michigan.

Hussander, Martin Clarence, M.E., who is Secretary-Treasurer of Albin J. Liepold, Inc., 541 Diversey Pkwy., has recently changed his address to 1526 Washington Ave., Wilmette, Ill.

MISSING MEN

Becker, George
Berman, William
Hamid, Chaudhari A.
Jacobs, Leo Barker
Kloer, Charles G.
Kornacker, Francis J.

1927

Fraser, Cyril Carey, M.E., who has been Chief Engineer for the Wander Co., Villa Park, Illinois, is now Power Supervisor for the E. I. du Pont de Nemours & Co. at Seaford, Delaware. He is residing at Seaford Inn, Seaford, Delaware. He writes that next summer he expects to move to Martinsville, Virginia as Power Supervisor in the Nylon Plant being built there.

Goetz, Marcus T., E.E., is Development Engineer for the Teletype Corporation, 1400 Wrightwood Avenue, Chicago, and has recently moved to 5731 N. Rockwell St., Chicago.

Hall, Perry C., E.E., is a Development Engineer for the Universal Cooler Corp., Marion, Ohio. He writes his present work consists of laboratory testing and design of coolers. His home address is 676 S. Prospect Ave., Marion, O.

Kuffel, Wilton F., F.P.E., was recently made Assistant Manager in the Cook County office of the Phoenix-Connecticut Group of Fire Insurance Cos. He was formerly Engineer in this same office.

Lovejoy, Maurice Elmer, Ch.E., who is Instructor in Chemistry and Physics at Frances Shimer Junior College, Mount Carroll, Illinois, lives at 408 Ridge St., Mount Carroll, Illinois.

Sairs, Leonard K., C.E., who is Tool Supervisor, Bucyrus-Erie Co., 3210 Claremont Ave., Evansville, Ind., has changed his address to 3038 West Franklin St., Evansville, Ind.

Zwiers, John R., C.E., writes to the Alumni Office, under date of January 14, 1941, from Caracas, Venezuela, (c/o Caribbean Petroleum Co., Apartado 809) as follows:

Gentlemen:

For some time I had known that there was something missing in my life and just the other day I found out what it was; I haven't been getting my Armour Engineer and Alumnus! So will you please change the address that you have in your files so that once more I will be able to get my copy.

It's kind of a long story how I got down here, but here it is in brief: I had been transferred by the Shell Oil Co. from Chicago to Jacksonville, Florida. I had been there only about 9 months when the opportunity was given to me to be transferred to another one of the Shell group, the Caribbean Petroleum Company, with headquarters in Caracas, Venezuela. It meant a considerable advancement for me, so the transfer was accepted. After a short training period in New York, I arrived in Caracas on the 21st of June, 1940. Titles do not mean anything down here, but on the record I'm supposed to be the Assistant Engineer, although on the trips to the interior we may be anything. At the present I'm particularly interested in the Engineering from the Sales organization viewpoint, so that the reduced production down here due to the war hasn't affected us to any large extent. However, in the fields there has been quite a reduction in the flow of oil. As the major part of the income of this country is derived from the sale of petroleum products, such restricted flow has been keenly felt here, and has necessitated some very drastic economies. A good percentage of the Government Engineers were Americans, but during the last couple of months a considerable percentage of them have returned to the States. However, there is plenty of work to be done down here, and as soon as the production is back to normal there will be a big "boom" on here.

Oh yes, in another instance, your records might be wrong. On Dec. 28th, 1939, my legal status changed, so that now I'm a married man.

I'll be looking forward very much to receiving the Armour Engineer and Alumnus again, and if you have any recent back numbers that are lying around loose, I'd appreciate receiving them also.

MISSING MEN

Berkson, Aaron
Cailles, B. Z.
Chaves, Frank C.
Dunham, Sylvanus Vene
Emerson, Ralph W.
George, Herbert R., Jr.
Hayes, A. B.
Koeffer, John J.
Larson, Edwin A.
Lee, George Harold
Schiesch, Carl G.
Thompson, G. W.
Verano, Victorio Q.
Weinberg, Joseph

1928

Chandler, Charles S., F.P.E., who Special Agent for the Great Americ Ins. Co., 625 Shelby, Detroit, Mich., h recently moved to 15109 Holmar, Detro Michigan.

Graf, Paul Anthony, C.E., who Plant Manager for Container Corporati of America, 1301 W. 35th Street, Chica has recently changed his address to 82 Langley Ave., Chicago.

Grosguth, Joseph, Jr., Arch., was ma ried to Miss Olive Fisher, April 6, 19 Residence is at 205 Washington Stre Oak Park, Illinois.

Hieber, Paul, C.E., who is a Sta Highway Engineer, Division of Highwa Courier News Bldg., Elgin, Ill., has r ently changed his address to 917 S. S Johns Ave., Highland Park, Ill.

Kriegir, Harry Leland, F.P.E., En neer, Ohio Inspection Bureau, 131 Broad Street, Columbus, Ohio, has r ently moved to 1755 Wyandotte Rd., C lumbus, Ohio.

Langan, Richard K., F.P.E., is Sta Agent for the Great American Insuran Co., 1194 Starks Building, Louisville, K and resides at 2307 Gladstone, Louisvil Ky.

Lohner, Carl Leonard, M.E., who Industrial Engineer, Swift & Co., U. Yards, Chicago, Ill., has moved to 76 S. Vernon Ave., Chicago.

Miller, Leo B., F.P.E., is State Age for the Pacific Fire Insurance Co. a Bankers & Shippers Insurance Co., 7 Penobscot Bldg., Detroit, Mich. His hor address is Walled Lake, Michigan.

Smethells, John M., announces t arrival of a bouncing baby boy to t Smethells household on August 19, 19 Named Charles Richard.

Tracy, Maurice B., E.E., who is in t Personnel Department of the Gene Electric Company at Bridgeport, Con was recently in Chicago interviewi graduating engineers for the Gene Electric Co. Similar visits were made engineering colleges in the middle-we Tracy's home is at 929 Wilcoxson, Str ford, Conn.

Ure, Harry C., C.E., who is Engine for Arthur J. O'Leary & Son Co., 57 W. 65th St., Chicago, is residing at 645 89th Street, Chicago.

MISSING MEN

Gustafson, Gust A.
Marhoefer, Lawrence Joseph
Ogden, Tom

1929

Blume, Ernest A., F.P.E., is Fire Survey Engineer for the Mill Mutuals, 800 Flour Exchange, Minneapolis, Minn. He resides at 4016 Drew Ave., So., Minneapolis, Minn.

Ericksen, Arndt Francke, Arch., who is Sales Engineer for the Detroit Stoker Co., 333 N. Michigan Ave., Chicago, is now residing at 663 Highland Avenue, Glen Ellyn, Illinois.

Johnson, Carl H., F.P.E., is Special Agent for Crum & Forster, 1406 Northwestern Bank Bldg., Minneapolis, Minn., and is residing at 5340 Penn Ave. So., Minneapolis, Minn. He writes "The name of Johnson will continue for I can report a son, Paul, born June 30, 1940."

Kernan, J. Melvin, C.E., who is Manager, Folding Carton Division, Container Corp. of America, Manayunk, Philadelphia, Pa., has recently moved to 9 E. Wynnewood Park, Wynnewood, Pa.

Kloepfer, George August, C.E., who is an Instructor, U. S. Navy, Naval Air Station, Pensacola, Florida, has moved to 302 Second Street, Warrington, Florida.

Stempel, Robert Edward, Arch., is now a designer in the Store Planning Department at Sears, Roebuck & Company, Arthington Street and Homan Avenue, Chicago. He also teaches Mechanical and Machine Drawing at Schurz Evening High School. His home address is R. F. D. No. 1, Mt. Prospect, Illinois.

Witting, Bernard A., F.P.E., who is Special Agent, St. Paul Fire & Marine Insurance Co., 1010 Lafayette Bldg., Detroit, writes that he has been married seven years and has a son $2\frac{1}{2}$ years old. His home address is 8113 Wisconsin Ave., Detroit, Mich.

MISSING MEN

Cooke, Earle Frederick
Garbett, Ralph
Lutz, Harold Rudolph
Montgomery, Glenn Merle
Rohr, Elwin Kinyon
Strom, George William

1930

Bigelow, Folger H., E.E., who is Sales Engineer for the Ilg Electric Ventilating Co. of Chicago, is residing at 1330 Eastmoreland, Apartment 3, Memphis, Tennessee. He was married to Miss Ruth Smith of Memphis, on August 17, 1940.

Chun, Edmund H., C.E., is with the U. S. Engineer Office, Massena, N. Y.

Jones, Charles Henry, F.P.E., who has been Special Agent for the Commercial Union Group of Fire Insurance Cos., with headquarters in Denver, Colorado, has been made State Agent for these same Companies with supervision over the mountain states area.

Rasmussen, Frederik A., C.E., who is Civil Engineer, City of Peoria, Room 308 City Hall, Peoria, Illnois, has changed his address to 301 Emery St., Peoria, Ill.

Reglein, Arthur T., F.P.E., who is an Inspector for the Iowa Insurance Service Bureau, has moved to 3615 Summit Ave., Sioux City, Iowa. He writes that he moved into his own home just in time to enjoy the Armistice Day blizzard.

Wahlstrand, Harold A., E.E., who is Engineer for the Teletype Corporation, 1400 Wrightwood Avenue, Chicago, has recently changed his address to 1005 N. Taylor Ave., Oak Park, Ill.

Winkler, Charles Thomas, Jr., M.E., who is Production Manager for the Reynolds Metals Co., 1259 S. Campbell Avenue, Chicago, has recently moved to 2425 Granville, Chicago. He writes: "Married for last two years. One exemption on hand—one on the way."

MISSING MEN

Dylewski, Thaddeus J.
Haegele, Allen Charles
Miller, Max J.
Montgomery, Hiram W.
Peterson, Fendell B.
Phillips, John V.
Pierce, Dana
Sanborn, Frank E.
Steck, Leon J.
Taylor, John L.
Van Valzah, Wm. S.
Whitfield, Marshall George
Wood, Marshall B.

1931

10th Year Reunion

For things to come—Watch '31 in '41. Already special mailing has gone ahead to the members of this class announcing plans for a reunion party that will overshadow any class reunion in the history of the Institute. An active committee consisting of Eldon Johnson, Bob Krause, Ed Paschke, Elmer Holin, Julian Lenke and Art Jens have completed preliminary work in developing the anniversary program.

Auerbach, Alvin Berthold, C.E., has been transferred from Fort Du Pont, Delaware, and now resides at 1139 Colonial Ave., Alexandria, Virginia. He now has the rank of Captain in the Corps of Engineers.

Collins, Robert B., M.E., is now employed as a Draftsman for Universal Oil Products Company, 310 S. Michigan Ave., Chicago. His home address is 4436 Elm Street, Downers Grove, Illnois. He is married and has a year old daughter.

Drell, Isadore L., Ch.E., who is a Job Analyst for the U. S. Employment Service and conducts analysis work for army jobs in connection with the National Defense Program, has recently moved to 5411 Woodlawn Avenue, Chicago.

Jennings, George J., Jr., E.E., who is Supervisor, Board of Education, 228 N. LaSalle, Chicago, has recently moved to 8337 S. Lanley, Chicago. For the last 8 years, he has been Tennis Professional at Northmoor Country Club, Ravinia.

Jordan, Philip J., C.E., who is Civil Engineer, Construction Division, Bureau of Engineering, City of Chicago, 334 W. 104th Place, has recently changed his address to 7911 Euclid Ave., Chicago. He is working at Stewart Avenue Water Tunnel.

Langhammer, Kenneth C., F.P.E., has recently joined the Indiana staff of the Great American Group of Fire Insurance Cos. as Special Agent. He was formerly an Inspector with the Indiana Inspection Bureau in Indianapolis.

Larkin, Maxwell C., F.P.E., is Special Agent for Travelers Fire Insurance Co., First National-Soo Line Building, Minneapolis, Minn. He has recently moved to 4221 Beard Avenue, So., Minneapolis, Minn.

Lindquist, Bert S., C.E., is a Lieuten-

ant in the Civil Engineer Corps., U.S.N.R., Navy Dept., Bureau of Yards & Docks, Navy Bldg., Washington, D. C. He was ordered to report for active duty November 14, 1940. He resides at 865 S. Ivy Street, Arlington, Virginia.

McArdle, Thomas O'Hare, C.E., who is now Industrial Engineer for the Lockheed Aircraft Corp., Burbank, Calif., has recently changed his address to 5529 Denny Ave., North Hollywood, Calif.

Murphy, Orland R., E.E., is in business at 910 West Lake Street. He recently moved to 1200 Belleforte Ave., Oak Park, Ill.

Rutt, Frank Edward, C.E., is Assistant Engineer, U. S. Engineer Office, Louisville, Ky., Federal Building, has moved to 226 N. Mt. Holly Ave., Louisville, Ky.

Weis, Henry Birdsall, M.E., who is Engineer, Central Fibre Products Co., 831 S. Front St., Quincy, Ill., has changed his address to 225 S. 23rd St., Quincy, Ill. He writes that he was married to Miss Virginia Ohnemus on August 25, 1939, and is now the proud father of twins, a boy and a girl, born Oct. 19, 1940.

Wilson, Robert Neal, F.P.E., is now Engineer and Associate Manager, Industrial Advisors Bureau, Inc., Insurance Agency Division, 714 N. B. C. Bldg., Cleveland, O., and is living at 3168 W. 151st St., Cleveland, Ohio.

MISSING MEN

Ferguson, Leslie J.
Hotchkin, Mark A.
Miles, Wallace
Yzaguirre, Manuel A.

1932

Beal, Marshall Robert, F.P.E., who is Special Agent for the Automobile Insurance Co. of Hartford, Conn., has recently changed his business address to 11th floor, Merchants Bank Bldg., Indianapolis, Indiana. His home address remains 4221 N. Guilford Ave., Indianapolis, Ind.

Carlton, Edward Williams, now heads his own engineering firm which is located at 8 South Dearborn Street, Chicago. Residence is at 1450 West Glenlake Avenue, Chicago.

Casey, James Joseph, C.E., is now em ployed by Sanderson & Porter and liv in Wilmington, Illinois.

Freer, Donald Edgar, F.P.E., is no Branch Manager of the Kentucky Act arial Bureau, 518 Second National Ba Bldg., Ashland, Ky. He is married a has a daughter born April, 1939. H resides at 1904 Hilton Ave., Ashland, K

Heckmiller, Ignatius A., C.E., who Junior Engineer, U. S. Geological Surve Indianapolis, Ind., has recently chang his address to 6041 Indianola Av Indianapolis, Ind. He is married and h two daughters.

Koch, Albert Arthur, C.E., who is Associate Civil Engineer, U. S. Engine Office, South Pacific Division, 351 Ca fornia Street, San Francisco, Calif., h recently changed his address to 28 Derby Street, Berkeley, California.

Schultz, William G., F.P.E., who an Engineer with the Lumbermens Mutu Insurance Co., Mansfield, Ohio, resides 527 Crescent Road, Mansfield. His daug ter, Diana Jeanne, age six, has a 15-mi ute program on radio station WMA Sunday afternoons. She also played t part of "Pud" in "On Borrowed Tim with the Toledo Repertoire Theatre.

Stahm, E. Boris, Arch., is Architectur Draftsman, City Planning Commissio Room 260, Civic Center, San Diego, Ca and is residing at 731 Yarmouth Ct., S Diego, Cal.

Tonsager, Howard Arthur, Arch., wh is Draftsman, Schmidt, Garden & Erikso 104 S. Michigan, Chicago, has moved 427 Bonnie Brae, Hinsdale, Ill. He r ports that he now has a M.A. degree Architecture from M. I. T. and is al a registered architect in Illinois.

Wegner, Elmer August, E.E., who Sales and Service Engineer for the Wes inghouse Electric & Mfg. Co., 14 Franklin St., Chicago, is residing at 14 Highland St., Berwyn, Ill.

Wiltrakis, Edward Joseph, C.E., w is now a Lieutenant in the U. S. Arm writes to the Alumni Editor from 322 Veitch Street, Arlington, Virginia, follows:

Hello:

Just to be certain that I keep on recei ing the Armour Engineer I am send you my latest mailing address which is given above.

For the past two and a half years have been working with the U. S. Eng neers at Little Rock, Arkansas, in t Hydraulics Sub-section. I had joined t Engineer-Reserves back in 1935, and December 17th last I was ordered in extended active duty with the Corps Engineers. I am just completing a fi weeks intensive course at Fort Belvo Virginia, and have been permanent assigned for the balance of the year f duty with the Engineer School at Fo Belvoir and so will be remaining in the parts for a while.

This five weeks course has required th I remain on the post all week, getti away only week-ends. So I have hard been able to see my family. I locat my wife and fourteen months old s John in Arlington about seventeen mil from the Fort.

While at Little Rock I worked with F Rult, who graduated a few years befo I did. He was still working in the Desi Section when I left. Coming through various times, Frank Hromada (C.E. '3 stopped in on his way to his job as Sa tary Engineer at the Federal Penitentia at El Reno, Oklahoma. He took to hi self a wife last Spring.

MISSING MEN

Bogot, Alexander
Casper, Joseph
Combs, Harold F.
Eskonen, Oscar
Fox, Charles Henry
Hromada, Frank Miles
Matheson, Donald MacRae
Miccucio, Michael J.
Skrakowski, Edward
Toopeekoff, Eugene
Vaughn, William T.

1933

Andersen, Walter George, Arch., who is Chief Draftsman for the National Youth Administration Architect's Office, 222 W. North Bank Drive, Chicago, has recently moved to 4517 N. Rockwell St., Chicago.

Barnett, Orville Theodore, Ch.E., is Engineer of Tests for the Metal & Thermit Corporation, 92 Bishop St., Chicago. He resides at the Embassy Hotel, Chicago.

Booth, William G., Ch.E., was recently transferred by the Union Special Machine Company to St. Louis, Missouri.

Cameron, Howard James, C.E., is Park Engineer, Shenandoah National Park, Luray, Va., U. S. Department of the Interior, National Park Service, Luray, Va. He is living at 171 S. Court St., Luray, Va.

Kubicek, Earl Charles, Arch., who is Chief Clerk, General Agent Passenger Dept., The Milwaukee Road, Room 711, 100 W. Monroe St., Chicago, is now residing at 547 E. 73rd St., Chicago.

Larsen, Henry A., C.E., who is salesman for the Western Shade Cloth Co., has recently moved to 600 Westmoreland Ave., Kingston, Pa.

McIntyre, Alexander M., E.E., who is with the Electric Controller & Manufacturing Co., 2700 E. 79th Street, Cleveland, Ohio, has recently changed his address to 3103 Essex Rd., Cleveland Heights, Ohio. He writes that after May 1, 1941, his office will be at 310 South Michigan Avenue, Chicago.

Nelson, Clifford A., F.P.E., is Special Agent for the Home Insurance Co. of New York, 1800 Buhl Building, Detroit, and is residing at 14595 Terry Avenue, Detroit, Mich.

Smethells, William T., F.P.E., who is Special Agent, Detroit Fire & Marine Insurance Co., 412 State Bank Building, has moved to 619 N. Elmwood Ave., Traverse City, Mich.

Vanderpoorten, Stephen Ashley, F.P.E., who is Inspector, Michigan Inspection Bureau, may be reached at Box 2719, Detroit, Mich.

MISSING MEN

Berquist, Raymond G.

1934

Anders, Archie, M.E., is now Aeronautical Engineer for Lockheed-Vega at Burbank, California. He took an extensive course in Aeronautical Engineering at California Tech. He now resides at 967½ N. Serrano, Hollywood, Calif.

Clarkson, Clarence W., E.E., was employed as an Electrical Engineer by the R. B. M. Mfg. Co., Logansport, Indiana, on December 1, 1940. He is residing at 96 E. Market St., Logansport, Indiana.

Ellis, Raymond Laurence, F.P.E., who has been employed since June, 1939, by R. B. Jones & Sons, Inc. Insurance Agency, 301 W. 11th St., Kansas City, Mo., as Assistant Engineer is now residing at 4031 Garfield Avenue, Kansas City, Missouri. He is married and has two children, a son and a daughter.

Harwood, Richard E., F.P.E., who is an inspector for the Ohio Inspection Bureau, 1010 Schmidt Bldg., Cincinnati, Ohio, has recently moved to 2832 Harrison Avenue, Cincinnati, Ohio.

Kostenko, Barry Michael, C.E., who is Technical Associate, Sueske Brass & Copper Co., 13 North Peoria Street, Chicago, is now residing at 227 S. 19th Avenue, Maywood, Ill.

Marty, Raymond W., Ch.E., who is in the Engineering & Research divisions of Phoenix Metal Cap Co., 2444 W. 16th St., Chicago, has moved to 1933 N. Kimball, Chicago.

Storey, Donald G., C.E., is a Junior Civil Engineer, Sanitary District of Chicago, 910 S. Michigan Avenue, Chicago. His home address is 8041 S. Perry Ave., Chicago.

Svoboda, Emil Anton, M.E., is now Sales Engineer for the Ampco Metal, Inc., Milwaukee, Wis. He is residing at 3330 N. Meridian Street, Indianapolis, Indiana.

Thompson, Paul James, E.E., who is Expense Controller for Montgomery Ward & Co., Baltimore, Md., has changed his address to Apt. 53, Oaklee Village, Baltimore, Md.

MISSING MEN

Adrian, George H.
Anderson, Andrew John
Bech, Jose A.
D'Alba, Louis
Davison, Stephen P.
Eberly, Kenneth C.
Gibian, Francis M.
Korink, George T.
Larson, Walter H.
Masure, Charles P.
Mills, William R.
Spangler, Charles D.

1935

Birdsong, John M., M.E., who is Industrial & Methods Engineer for the Hydraulic Control Department of the General Electric Co., Schenectady, N. Y., has moved to 1½ Washington, Schenectady, New York.

Bristol, Curtis Robert, F.P.E., accepted a position traveling Kentucky and Tennessee for the North British & Mercantile Insurance Co., 518 Starks Bldg., Louisville, Ky., on October 1, 1940, after having been with the Kentucky Actuarial Bureau since 1935. His home address is 1844 Roanoke, Louisville, Kentucky. On April 10, 1940, he became the proud father of a baby girl.

Curran, John Martin, C.E., who is Layout Engineer for E. I. duPont, Charlestown, Ind., has recently changed his address to 1100 E. 9th St., Jeffersonville, Indiana.

DeLang, Theodore George, C.E., is Chemical Engineer, Motor Products Development Division, U. S. Rubber Co., Detroit, Mich. He has recently moved to 4706 Nottingham Rd., Detroit, Mich.

Goldberg, Charles K., M.E., who is Designer with the Clearing Machine Corp., 6499 W. 65th St., Chicago, has recently moved to 7955 S. LaSalle St., Chicago.

Hedin, Robert Harry, F.P.E., who is in the Underwriting Dept., Hardware Insurance Co., 2344 Nicollet Ave., Minneapolis, Minn., is married and is now living at 2222 Harriet Avenue, Minneapolis, Minn.

Jones, Barclay VanCott, C.E., who is Job Analyst for Spiegel, Inc., 1040 W. 35th St., Chicago, was married on June 1, 1940, to Miss Georgette M. Becker of Wilmette. Residence is at 114 Maple Ave., Wilmette, Ill.

Kettlestrings, David Willis, C.E., who is Structural Draftsman, The Mississippi Valley Structural Steel Co., 25th Ave. & Norwood St., Melrose Park, Ill., has recently changed his address to 706 N. 5th Ave., Maywood, Ill. He has a two year old son, Donald.

Messinger, Bernard L., M.E., who is a Mechanical Research Engineer for Lockheed Aircraft Corp., Burbank, Cal., is residing at 10920 Massachusetts Ave., Westwood, Los Angeles, Cal.

Nicholai, William, Arch., who is Architectural Designer for the Pure Oil Co., 35 E. Wacker Drive, Chicago, has recently changed his address to 1305 Sunnyside Ave., Chicago Heights, Ill.

Varone, Ralph A., E.E., who is Radio Design Engineer, R. C. A. Mfg. Co. (Special Apparatus Engineering Division), Camden, N. J., has moved to 256 White Horse Pike, Audubon, N. J.

Wolf, Arling Martin, E.E., who is Sales Engineer for Cutler-Hammer, Inc., 2755 E. Grand Avenue, Detroit, Mich., has recently moved to 14150 Linville, Detroit, Mich.

MISSING MEN

Hess, Robert A.
Jones, Thomas F.
Kaminsky, Morris M.
Kvapil, Gastav L.
Lewis, William F.

1936

Balai, Nicholas, Ch.E., who is an Engineer with the Universal Oil Products Co. in Chicago, was married on September 28, 1940, to Miss Margaret Lillian Anderson.

Cole, James D., E.E., who is an Electrical Engineer for the Joslyn Mfg. & Supply Co., 3700 S. Moran St., Chicago, was married on August 18, 1940, and now lives at 447 N. W. Highway, Park Ridge, Ill.

Fleig, Donald Henry, E.E., who is a Patent Engineer for the Bethlehem Steel Company, Bethlehem, Pa., has recently moved to 17 E. Lehigh Street, Bethlehem, Pa.

Gallagher, Francis Hugh Edward, M.E., is now an Air Conditioning Engineer for Pedro Martinto (Carrier Corp. representative) Edificio Raffo, Avenida De La Colmena, Dpt. 701, Lima, Peru, South America. He may be reached at 185 N. Lamon Ave., Chicago.

Gilkison, Thomas Mortimer, ChE., who is Chemical Engineer in Research, Anderson Clayton & Co., Houston, Texas, was married Oct. 26, 1940, to Miss Betty Bartley of Ft. Worth, Texas. His home address is 1743 S. 8th, Abilene, Tex.

Kirsch, Earl James, E.E., who is an Electrical Engineer for the Standard Transformer Co., was engaged on Decem-

ber 25 to Miss Bernice Thorsen of Oak Park, Illinois.

Knaus, Rodger Gottfrid, E.E., who is Assistant Sales Engineer for the General Electric Co., Chicago Office, 819 S. Canal St., Chicago, has changed his address to 4931 W. Ainslie St., Chicago.

Kraus, Albert E., E.E., who is Factory Representative for Champion Spark Plug Co. of Toledo, Ohio, is now residing at 2949 West Chase Ave., Chicago. He writes that he built a new home at the above address, and is about to be a proud papa.

Maack, Albert H., C.E., who is Metallurgist for Wisconsin Steel Co., 2701 E. 106th St., Chicago, has moved to 3115 W. 62nd Street, Chicago.

Neal, Donald John, F.P.E., who is Special Agent for the National Fire Insurance Co., 42 E. Gay Street, Columbus, Ohio, writes that he started with the National in June, 1939, and spent one year in the Engineering Dept. in Chicago. He and his wife have been residing in Columbus since Sept. 1, 1940. They have a baby boy almost one year old.

Patterson, Robert Olson, M.E., who is Sales Engineer with the Powers Regulator Co., Chicago, recently won the 155 lb. wrestling championship in the Amateur Athletic Union finals in Chicago.

Timberlake, David Charles, F.P.E., who is an Engineer with the Kentucky Actuarial Bureau, 940 Starks Building, Louisville, Ky., has recently changed his address to Apt. A-6, Green Tree Manor, Louisville, Kentucky.

Vaillant, Ben, E.E., who is with the Burgess Battery Co., Freeport, Ill., married Miss Virginia L. Rader on Jan. 4, 1941, and will reside in Freeport, Ill.

MISSING MEN

Fogle, William H.
Holland, Milton B.
Peterson, Robert C.

1937

Bartusek, Joseph F., M.E., who is an Instructor in Plant Trades at the Western Electric Co. Hawthorne Works, was the proud father of a son born August 30, 1940. He has changed his address to 718 N. Pine Avenue, Chicago.

Bauermeister, Herman Otto, Ch.E., is a Patent Examiner in the U. S. Patent Office, Washington, D. C., and is living at 1425 Rhode Island Avenue, N. W., Washington, D. C.

Carroll, Kenneth Frederic, M.E., who is now Assistant Process Engineer for Linde Air Products Co., East Park Drive & Woodward Ave., Tonawanda, N. Y., is residing at 1975 Delaware Ave., Buffalo, N. Y.

Cichanowicz, Eugene G., C.E., is Structural Designer for the Solvay Process Co., Hopewell, Virginia. He has recently moved to 120 Lee Ave., Colonial Heights, Petersburg, Va.

Crapple, John W., M.E., started working as Inspection Engineer for the Universal Casting Corp., 5821 W. 66th St., Chicago, on December 18, 1940. He was married on October 26, 1940, and lives at 1936 Quincy St., Chicago.

Damiani, John H., M.E., is a Junior Instructor (Civilian) in the Engine Testing Branch of the Army Air Corps Technical School at Chanute Field, Rantoul, Illinois. His home is also in Rantoul.

Gerber, Norton, Eng. Sc., is an Industrial Engineer for the Allied Radio Corporation, 833 West Jackson Blvd., Chicago. His home address is still 807 Waveland Ave., Chicago.

Gunther, Wilbert M., F.P.E., who has been an Inspector with the Ohio Inspection Bureau in Dayton, Ohio, recently joined the Engineering Department of the Springfield Group of Fire Insurance Cos. in their Chicago office. Residence will be at 4151 N. Kedzie Avenue, Chicago.

Kendall, Nat S., C.E., is the Civilian Engineer attached to the Quartermasters Corps supervising construction of the huge Chrysler tank plant in Detroit.

Mandelowitz, Abe, M.E., who is Junior Inspector of Engineering Materials, Navy Department (Office of Inspector of Naval Material) 844 Free Press Bldg., Detroit, Mich., has changed his address to 12835 LaSalle Blvd., Detroit, Mich.

Sulinski, Sigmund J., C.E., is now employed by the Healy Subway Construction Corp., 221 N. LaSalle St., Chicago and lives at 3910 W. Barry Ave., Chicago.

Ziemann, Alfred E., E.E., who is Engineer G. E. X-Ray Corp., 2012 W. Jackson Blvd., Chicago, has moved to 117 S. Wesley Ave., Oak Park, Ill.

MISSING MEN

Houtsma, Jacob H.
Johnson, Berth. W.
Lange, Robert N.
McGrath, Joseph K.

1938

Arends, Edward William, F.P.E., is an Inspector for the Western Factory Insurance Association, 3423 Barlum Tower, Detroit, Mich., and resides at 14263 Hubbell, Detroit, Mich.

Chelgren, William Judd, M.E., who i

ieneral Foreman in the Rim Fire Ammunition Plant of the Remington Arms Co., nc., Bridgeport, Conn., has recently hanged his address to 2886 Nichols Aveue, Nichols, Conn.

Malmfeldt, Carl S., M.E., was married n June 1, 1940, to Miss Lily Ahlstrom nd is now residing at 438 E. 81st St., hicago.

Monson, Ronald, C.E., who is Draftsian in Hull Government Division, Newort News Shipbuilding & Drydock Co., 101 Washington Ave., Newport News, 'a., has moved to 400 Cherokee Rd., lampton, Va.

Rodkin, David Bernard, M.E., who is unior Engineer, Navy Yard, Puget ound, is now residing at 1148 Hewitt venue, Bremerton, Washington.

Jerry Danek, ChE., was killed in an xplosion at the plant of Edwal Laboraories, Inc., February 11, 1941. He had een employed there for about eighteen ionths. During his four years at the nstitute Mr. Danek made a scholastic ecord well above the average. He was member of Alpha Chi Sigma and Phi ambda Upsilon. The Institute and the lumni sympathize most deeply with his oung widow.

MISSING MEN

Close, II, R. G.
Kreiman, Sidney S.
Sellen, Charles E.

1939

Derrig, George J., M.E., is Assistant to echnical Director of the Buda Company, larvey, Illinois. His work consists of ompleting engine reports, special calculaons for particular engine application. id preparing materials for laboratory sts. He resides at 1535 Highland Avee, Chicago.

Harris, Charles W., C.E., who is Cost ccountant, Lee Bradley Linoleum & ile Co., 2405 E. 15th, Kansas City, Mo., now residing at 3503 Morrell, Kansas ity, Missouri.

Miller, Samuel P., M.E., is in the ngineering Dept. of the Consolidated ircraft Corp., San Diego, California.

Peterson, Carroll V., Ch.E., is Chemil Engineer, Metallurgical Dept., Cargie-Illinois Steel Corp., Clairton, Pa., id is residing at 552 Halcomb Avenue, lairton, Pa.

Swanson, Edward R., F.P.E., who was i Inspector for the Ohio Inspection ureau, writes that on Jan. 8, 1941, he ilisted in the U. S. Navy Air Corps.

Van Alsburg, Earl, M.E., who is a raftsman for the Consolidated Aircraft orp., Lindberg Field, San Diego, Calif., es at 3741 India Street, San Diego, alif. He writes that Sam Miller '39, id Leonard Holmes '37, are also emoyed in this engineering department.

Young, Richard W., M.E., who is Engier, Danly Machine Specialties, Inc., 2101 2nd St., Cicero, is residing at 521 S. dson Ave., Lombard, Ill.

MISSING MEN

Davis, Robert Allen, III
Lindahl, John Carl
Pater, Anton Stanley

1940

Byrne, Charles J., Jr., E.E., is now a evelopment Engineer for Jefferson Elecic Co., Bellwood, Illinois, and is residing 5114 S. Christiana Ave., Chicago.

Horton, William D., Arch., is now idustrial Designer for Montgomery 'ard Co., 619 West Chicago Ave., Chigo, and resides at 7464 North Ashland venue, Chicago.

Olufsen, George, C.E., is Junior Stress nalyst for Glenn L. Martin Aircraft o., Middle River, Maryland. His home address is 3702 Greenmount Ave., Baltimore, Md.

Pedersen, Arthur Hall, C.E., who is Engineer, Glenn L. Martin Co., Baltimore, Md., was married on August 24, 1940, and is residing at 2900 Hillcrest Ave., Baltimore, Md.

Wessels, Delano Eugene, Ch.E., who was with George Kock Sons, Evansville, Indiana, left January 18, 1941, for a year of training under the Selective Service Act. His address will be La Feria, Texas.

Smith, Roger K., F.P.E., reports a successful four month trip through Mexico and Central America covering some 4000 miles with a canteen, a butterfly net, plenty of enthusiasm, and a motorcycle. Newspaper accounts of the journey indicate that Smith and his companion enjoyed many "unusual experiences" but were more than glad to be back home with a chance to rest. Smith is an Inspector with the Michigan Inspection Bureau and resides at 3214 Carter St., Detroit, Michigan.

NEW CAMPUS

(From page 7)

of knowledge and human welfare through fundamental research.

"That these resources should be applied to the training of efficient personnel for industry . . . not only as undergraduates, but also on the highest scientific levels, through its Graduate School.

"That the resources of the Armour Research Foundation be applied to the provision of capable scientists and adequate equipment for the solution of industry's technical problems in materials and processes.

"That the great industrial region of which Chicago is the hub requires a 'technological center' of and for its own, equal to the best in the nation, and that Illinois Institute of Technology can and will become that center."

While early financing activities will be centered largely in the Chicago area, it is planned to provide ample opportunity for the alumni to participate in this program before the close of the year, and developments in this connection will be announced in later issues of The Engineer and Alumnus.

35 WEST 33RD STREET

(From page 12)

models, and this method has been used with considerable success in connection with turbines and valves.

The scope of work in the Light Division is indicated by the broadest meaning of the name. In its present enlarged quarters this division now handles research involving optics, illumination, X rays and X-ray diffraction, spectrography, and virtually every application of photography and photographic processes. Experimental work in this field nearly always requires special expensive equipment, and a comparatively simple measurement may call for apparatus amounting to several thousands of dollars in aggregate value. Such equipment has a long life of service, however. The Research Foundation has assembled an ever-increasing amount of optical apparatus which, by the exclusion of standard routine testing work, is reserved for use by industry in research projects. Noteworthy among recently added pieces is a precision spectrophotometer, one of the few instruments of its kind in this part of the country.

Of the various laboratories of the Light Division, the one of greatest general interest is probably the darkroom. While not the only one of its kind, this is certainly a "last word" in photographic workrooms. Large enough to accommodate several operators simultaneously, its benches and cabinets are of white enameled steel with stainless steel working surfaces. The white walls afford maximum visibility in the dim illumination of safelights. Divided into two parts by a partition, the room allows operations to be conducted in light and total darkness at the same time. Water to all sinks is filtered and adjusted thermostatically to the desired temperature and this temperature is read directly on a dial thermometer connected above each sink. Other built-in features include a spacious electric drying cabinet and a thermostatic bath to maintain proper temperatures in developing tanks and trays. Printing and enlarging apparatus is equipped with automatic timing controls. Fresh air is circulated by fans and ducts. A dark maze permits entrance to the room without interruption of work in progress. A photographer's paradise, the darkroom is constantly being improved to handle most efficiently the mass of record photographs, X-ray plates, spectrograms, report illustrations and experimental films occasioned by the many research projects.

Research in the Metallurgy Division has expanded rapidly with the addition of the experimental foundry building. The project for the improvement and development of the Wetherill process of counter-gravity pressure die casting of gray iron has attracted much interest and has reached the stage of production in the mechanized pilot plant. Other projects during the past year include investigations in abrasion-resistant metals, cavitation erosion, coal beaters, and foundry practices.

Many of the projects placed in the hands of the Armour Research Foundation are of such confidential nature that not even their subjects can be announced. Sometimes the sponsoring concern asks that the company name be kept secret, for competitive reasons. In other cases a certain part or even all of the information gained may be contributed to the scientific literature, depending upon the wishes of the sponsor. It is recognized that frequently the creation of new things for the betterment of mankind can be given the necessary impetus only through competition, which implies confidential research. It appears, therefore, that in this way the Armour Research Foundation can best serve its fast-growing list of industries.

LOUP RIVER

(From page 26)

transmission line from Lincoln to Omaha, and a 69-KV, 60-cycle, three-phase transmission line from Columbus to Norfolk, Winside and Belden; and substations located at Lincoln, Omaha, Fremont, Norfolk, Winside and Belden.

The 115-KV transmission lines are built of "X" braced "H"-frame wood pole type on tangents and small angles and the conductors are carried in horizontal configuration. Each structure has a double cross-arm with filler blocks and attachments for the suspension insulators. The average span is 700 feet. The angle dead-end and strain structures are self-supporting steel towers. Double-circuit steel towers were constructed on the two miles adjacent to the Lincoln substation on the Columbus-Lincoln line. The insulators are porcelain, 10″x 5¾″ cap and pin type. On the "H" frame wood structure seven units are used in suspension, and on steel towers ten units in strain and nine units in suspension for each jumper loop on the steel towers, where power conductors are dead ended in each direction. Protector tubes are mounted on each structure by a channel iron support, one tube for each conductor, except for about 3,000 feet adjacent to the substations where the transmission line is shielded against lightning b[y] means of an overhead ground wir[e]. The transmission line conductor is a[n] aluminum cable, steel-reinforced, wi[th] a cross section area of 336,400 C.M.

The Columbus to Norfolk, Winsid[e] and Belden transmission line w[as] similar to the 115-KV lines, exce[pt] that the protector tubes are omitt[ed] and the conductor has an area of 26[6]-800 CM.

The Loup River Public Power Di[s]trict is unified with the two other go[v]ernment-financed power projects [in] Nebraska, The Central Nebrask[a] Public Power and Irrigation Distri[ct] and the Platte Valley Public Pow[er] and Irrigation District. This combin[a]tion is the "Nebraska Grid System[,]" which is composed of the transmissi[on] lines of the three Districts. It [is] jointly operated by a Board of Ma[n]agers which consists of the gener[al] managers of the Districts. By poo[l]ing of revenues, the Loup Distric[t's] outstanding $9,268,000 in P.W.[A.] bonds were set up in a new financi[al] agreement with the Government. T[he] first bonds come due in 1946 and pa[y]ments are stepped up gradually f[or] the next fifty-nine years; the final pa[y]ment will be due in 2004.

The Loup District has been ave[r]aging over 9,000,000 KWH month[ly] for the past three winter months a[nd] should have no difficulty in paying o[f] its obligation to the U. S. Gover[n]ment. It has received in grants [to] this time a total of $3,400,000.

Recently Mr. Phil Hockenberg[er,] Armour Alumnus, 1915, was elect[ed] President of the Loup River Pub[lic] Power District, by the Board of [Di]rectors.

HEALD AWARD

(From page 7)

of the consolidation of Armour Ins[ti]tute of Technology and Lewis Ins[ti]tute to form Illinois Institute of Tec[h]nology. Let me explain that my ow[n] part in bringing about this combin[a]tion was very small indeed. Y[ou] probably all know that education[al] institutions are controlled by Boar[ds] of Trustees, consisting of public sp[ir]ited citizens, serving without compe[n]sation, and devoting their energies [to] their respective institutions solely f[or] the public good. The members [of] both these Boards, and particular[ly] their respective Chairmen, Mr. Jam[es] D. Cunningham and Mr. Alex Baile[y,] in developing the plan for the merg[er] of Lewis and Armour, recognized t[he] responsibilities of their trusteeship [to] an unusual degree. These two gent[le]men are really responsible for t[he]

combination and should have the credit for it. Then too the consolidation presented some very knotty legal problems, and here again we were fortunate in having in the membership of our Boards two attorneys, Mr. Louis S. Hardin and Mr. Benjamin Wham, who donated literally hundreds of hours of valuable time to bring the proceedings to a successful conclusion.

"Nor is the problem of successfully consolidating two old, well established educational institutions one that is limited to the actions of their Boards of Trustees. Over 100,000 people have attended these two colleges in the last forty-seven years, and these former students stand in somewhat the same position as the preferred stockholders of a business corporation. Without the acquiescence and support of most of this group, the merger proposal would have been doomed to failure. The faculties too have an important interest in a program of this kind, and here again, cooperation was the order of the day. In other words, what I am trying to say is that educational institutions are highly sensitive organizations in which many groups and individuals play an extremely important part, and certainly no one individual can possibly take the credit for an educational consolidation.

"Institutions of higher education, whether publicly or privately supported, exist to render a service. This service in the case of our institution takes two closely related forms:

"(1) the training of young people for useful citizenship through preparation for particular fields of business or professional activity, and

"(2) the advancement of knowledge through fundamental and applied research.

"Both Armour and Lewis have served youth, industry, and the community in these ways for many years. Illinois Institute of Technology is now carrying on this service in a more effective manner. Just a week ago, a plan for the future development of this new institution was announced. The completion of this plan will provide Chicago with not only the largest school of technology in America, but with the best. It will render incalculable service to the industries without which Chicago cannot continue to grow and to prosper. It will insure the young people of this community an opportunity for unexcelled technological education, and its contributions to research will provide new industries and place increased comforts of living within the reach of more people.

"This is the kind of an institution I visualize as growing from the merger of Armour and Lewis, and it is on behalf of this new center of technology that I accept the honor which you have so generously bestowed tonight."

ENGINEERING STUDENTS, 1940-1941

(From page 28)

next largest enrollments are at Purdue, 3487; City College, New York, 3278; and Texas A. and M., 3101. High graduate engineering enrollments are at Massachusetts Institute of Technology, 333 master's, 122 doctor's; New York University, 348 master's, 23 doctor's; Illinois Institute of Technology, 328 master's, 13 doctor's; Stevens, 337 masters.

Engineering schools in the United States conferred 11,358 and those in Canada 166 first degrees during the academic year 1939-1940, a total of 12,524. In the same year these schools conferred 1326 master's degrees (1318 in United States) and 108 doctor's degrees.

BOOK SHELF

(From page 32)

He basked in perfect idleness.
He'd talk to anyone in sight
On any theme, however trite;
Revolving every side of it,
He'd chew and talk, and talk and spit;
A skilled elucidationist.

The Black Butterfly of Carl H. Grabo is both the title of his fine collection, and that of one poem within the group of fifty-seven. By the simple expedient of binding various selected poems between two covers, Professor Grabo has produced an admirable addition to any library. Unlike *The Cock of Heaven* and *Hilltop in Michigan*, these poems have no interrelation other than a singleness of basic style. This unity of style, however, is not the boresome type that emanates from a set and prescribed form. It is rather an ever-present neatness, precision, and directness. Very pleasing, also, is the secure feeling that the author will never plunge beyond his depth, and soon will have to muddle his way out with some unwieldy phrase.

A philosopher who has evolved his own views on the subjects treated, the author has the good taste not to be the pedant with them. In general, the poems of this collection are too compact to allow the use of excerpts. However, two of the shorter, lighter ones will show that Professor Grabo stimulates the reader without loss of serenity. This is true whether he appeals primarily to the senses, as:

Dwindling like stars the street lamps shine
In marching columns, line on line;

Swift borne by tail-winds from the sea,
The sky's aerial squadrons flee;

With rush of wings and lightning flash
Thunder's emptied bomb-racks crash;

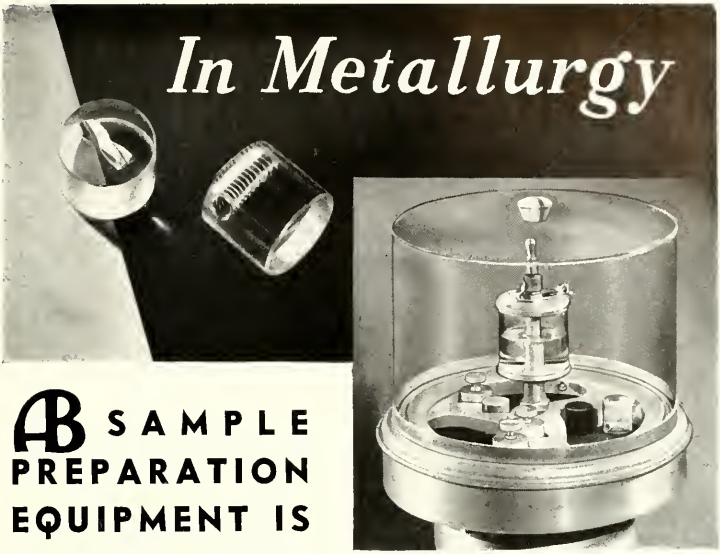
While, on the pavement's dark terrain,
Flickers the musketry of rain.

or, whether the burden of the lines is philosophical:

These limbs which well have served me
Soon I shall put by;
This heart, which knew less love than pain,
Then will quiet lie.

Should I be glad, or else lament
The fact that this be so?
For whether life or death be best
The dead can never know.

It is interesting to think upon the difference found in these three contributions to modern poetry. Mr. Seymour departs noticeably from the others in his conscious use of unpolished verse, wherever such verse would not fit situation or character. His nature is perhaps less that of the scholar, who finds the full life in a careful reworking of ideas. Had the poets lived in olden days, we might picture Mr. Seymour as a traveling artisan who composed his songs at the end of day, and played the minstrel as he passed from town to town. Professor Grabo might well have lived as head of the King's library. His late middle years were given to easy wanderings about the city, and to effortless writing grounded upon decades of study. Professor Olson might have been the earnest scholar who studied people long enough to ascertain their habits, but whose principal love was the host of ancient volumes wherein he sought the answers to his many questions.



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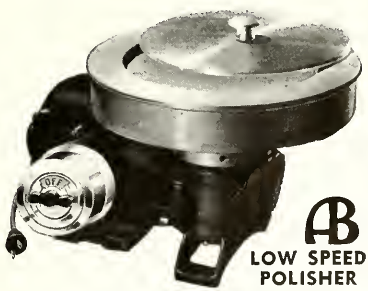

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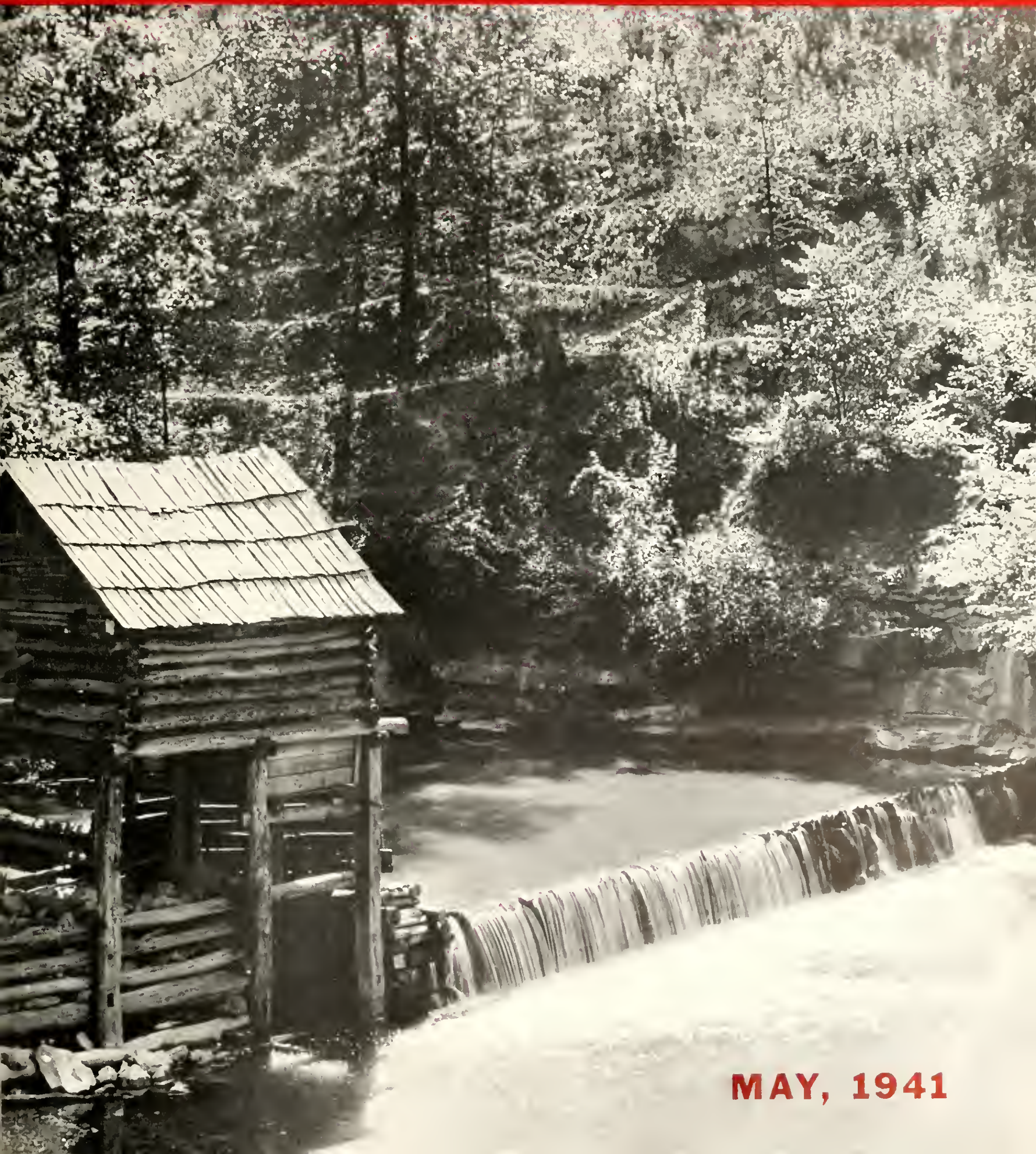

MAY, 1941

ARMOUR ENGINEER
AND ALUMNUS

MAY 1941

VOLUME 6 NUMBER 4

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Otto W. Hansen has been Engineer of Bridge Maintenance for the City of Chicago since 1928. Previously he was Engineer of Bridge Design for the City of Milwaukee, and Bridge Designing Engineer for Chicago entering the service in 1913. Mr. Hansen's college work was done in the architectural engineering department at the University of Illinois, at George Washington University, and at Lewis Institute.

George A. Kelly is a graduate of the University of Michigan, with the degree of LL.B. He is a member of the Illinois bar and practiced with the firm of Winston Payne, Strawn and Shaw from 1908 to 1920. In June of the latter year he became General Solicitor for The Pullman Company; since June, 1934 he has been Vice-President.

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S. A. Nock is Vice-President of Kansas State College. He received his B.A. degree at Haverford College, his M.A. at Carleton and his Ph.D. at the University of Tartu Estonia. His major research has been in Milton. Doctor Nock is noted as a reviewer and contributor to many magazines and scholarly journals.

Raymond E. Orton, Chief Engineer, Acme Steel Company, is an Armour graduate in the Class of 1928. He is the author of many authoritative articles on photoelastic analysis and other subjects relating to machine design. More extended notice appears in the alumni section of the March, 1941, issue.

Alexander Schreiber is Public Relations Officer of Illinois Institute of Technology.

Kanardy L. Taylor received his A.B. degree at Eureka College, and the degree of B.L.S. at the University of Illinois. He has been engaged in library work for twelve years. In 1934 he assisted in a survey of libraries in Illinois outside of Chicago. In the same year he was employed by the John Crerar Library as a cataloguer, and has served successfully as Assistant Reference Librarian and Reference Librarian. Mr. Taylor is now Chief of Public Service and personal representative of the Librarian. He is the compiler of several bibliographies in the reference series published by the John Crerar Library.

IN THIS ISSUE

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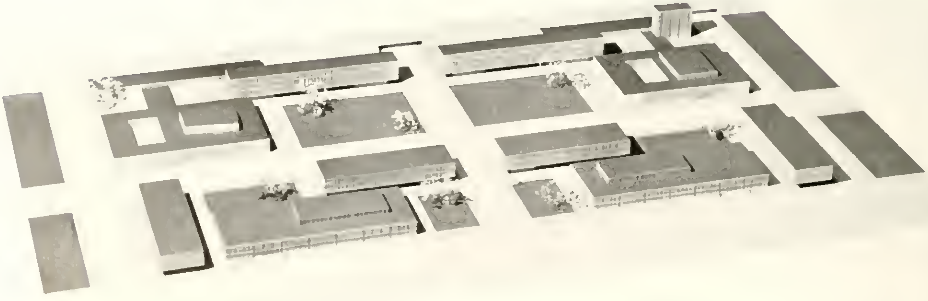
PROGRESS OF THE DEVELOPMENT PROGRAM

Formal action taken by the Board of Trustees of Illinois Institute of Technology at its annual meeting in Chicago on Monday, April 14, has resulted in the approval of revised plans for the 1941 phase of the Institute's development program, increasing the immediate building objectives to three specific projects, with a corresponding increase in construction costs from $1,274,000 to $1,500,000.

Plans for the development's current phase, as originally outlined by the policy committee of the Board, of which Wilfred Sykes, assistant to the president of Inland Steel, is chairman, involved two projects—a Metallurgical Engineering Building to cost, equipped, $256,000, and the Library and Humanities units, with an estimated cost of $1,018,000. By the Board's latest action, the budget for the Metallurgical Engineering Building has been increased to $332,000, and a third project, the erection of a Mechanical Engineering Laboratory unit, at a cost of $150,000, has been included in this year's financing program.

The urgency of demands for expanded quarters for Mechanical Engineering has become such that deferment of this laboratory project would seriously impede essential progress in the work of this depart-

Photo of a Model of the New Campus. State Street is at Lower Edge. Thirty-Third Street Crosses the Model Near the Center.



ment, the Trustees were told by Mr. Sykes and James D. Cunningham, chairman of the Board.

Simultaneous with approval of this revision in the original recommendation of the policy committee, the Board authorized immediate prosecution of an appeal for the funds required for this construction as well as for the addition of approximately $4,000,000 to general endowment—or the assurance by other means of annual income sources totaling $150,000, which would represent the equivalent of estimated yield on that amount if invested at the average rate of return from existing endowment funds.

Pursuant to this authority, Mr. Sykes has announced that plans will be made to launch such an appeal in the Chicago area during May. In the meantime, plans for the organization of alumni interest and support in the program, and for a definite approach to friends of education and of technological training elsewhere will also be developed.

Perspective and floor plans for the Metallurgical Engineering Building have been completed by Ludwig Mies van der Rohe, director of the architectural curriculum of the Institute, and are reproduced on these pages.

In preparation for the fund-raising effort, the Institute's development office has prepared a 24-page brochure descriptive of the program. Bound in red covers, the brochure, "This Is *Our* Job," is strikingly illustrated with photographs of classroom and laboratory activities, and sets forth the urgency of this great technological center development in the Mid-West in a concise but convincing manner. This publication will be placed in the hands of all prospects for gifts during the current phase of the appeal.

Similarly, as an educational prelude to the solicitation, the special committee of sponsors for small group meetings of industrial and civic leaders in the Chicago area, under the chairmanship of Thomas Drever, president of American Steel Foundries, has been proceeding with its program. As this article is being written, eighteen such meetings have been held, with a total attendance of 451 guests, who have listened to a comprehensive description of the Institute's plans from President Heald, Mr. Sykes, Mr. Cunningham, Professor John J. Schommer and others.

Mr. Sykes has also announced that Raymond J. Koch, president of the Felt and Tarrant Manufacturing Company, has accepted the chairmanship of a special committee which will undertake the responsibility for carrying the appeal to a selected list of prospects for larger contributions toward support of the program.

Other divisions of the campaign organization in the Chicago area include a special gifts group, a division to handle the general canvass, a publicity committee and a speakers' bureau. John M. Rodger, vice president of McGraw-Hill Publishing Company, is chairman of the publicity committee. Chairmen of the other divisions will be announced at an early date, according to Mr. Sykes.

Volunteer personnel enlisted in these divisions will total approximately 1,000, and through them a direct personal approach will be made to a list of about 10,000 individual prospects.

The 1941 phase of the development is the first in a continuing program which, present estimates reveal, involves building and income objectives amounting to a minimum of $3,000,000 for construction and equipment, together with an addition of some $9,000,000 to endowment, or the assurance of additional annual income equal to the prospective return upon such an invested amount.

Other building projects included in this continuing program over the next few years are:

A Civil Engineering and Materials Laboratory

A Chemical Engineering and Chemistry Building

An Electrical Engineering and Physics Building

A Student Union

A Physical Education Building and

A Power Plant.

Emphasis upon the necessity for this development at the center of Chicago's vast regional concentration of industrial enterprise was recently emphasized by President Heald in an address before the Chicago Rotary Club, where he discussed the subject, "Technology and National Defense," in his capacity as regional advisor for engineering defense training.

Under existing conditions, Mr. Heald pointed out, the demands of American industry call for the addition of at least 50,000 graduate engineers to the existing supply by the close of the year, whereas all of the nation's engineering schools will graduate at the most but slightly over 12,000. For normal replacements in the Chicago area alone, he added, 1,250 new engineers are required, and with existing abnormal demands for additional technological personnel, that total may well be doubled at this time.

Turning to the technological school in relation to the present problem, Mr. Heald said:

"It strikes me that too much emphasis has been placed on a definition of education as a process of preparation for what has been called 'life,' rather than the development of any degree of vocational competence. The public has been susceptible to most any pattern, more or less traditional in nature, of an extended educational program. It has believed that the greatest single factor making for individual security is education. Unfortunately, the experiences of millions of Americans, including a large percentage of youth, during the last ten years have not borne out this belief. Many who had this educational experience discovered that it has questionable connection with personal security. Now it would appear that emphasis is shifting from merely extended education to education which is functionally related to an understanding of occupational life and competency.

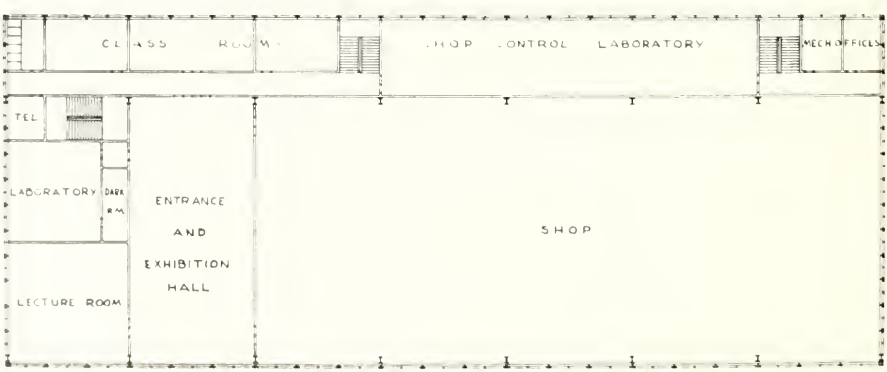
"The technologically trained man for years has been regarded as a pretty good person to have around when needed. He was welcomed when there was a bridge to be built or a machine to be designed, much in the same manner that one welcomes a plumber when the bathroom pipes have sprung a leak. On the other hand, the man who equipped himself with nothing more than a general education has managed to win recognition for himself as 'good company,' at least.

"However, this casual indifference toward the engineer has changed, almost overnight, it seems to me, into an intense interest. Americans have suddenly been awakened to the fact that our urgently-needed development of material resources is dependent upon our technologically trained human resources. . . .

"In connection with defense many people have been talking about the value of general education and cultural attainments as builders of morale. There can be no doubt that education, in every real sense to which that term can be applied, is an aid to the creation and maintenance of morale, just as ignorance tends towards its destruction. At the same time I cannot but feel that, for myself at least, it would prove a great morale booster to know that our country has an adequate supply of engineers, scientists, production experts and skilled workmen, applying themselves, in industry and in government to the task of providing our forces with the best fighting tools that can be produced anywhere in the world."

EDITOR'S NOTE. Alumni desiring copies of "This Is Our Job," may obtain same by writing to The Development Office, Illinois Institute of Technology, 79 W. Monroe St., Chicago, Ill.

Perspective (Above)
Metallurgical Enginee



FIRST FLOOR

or Plans (Below)
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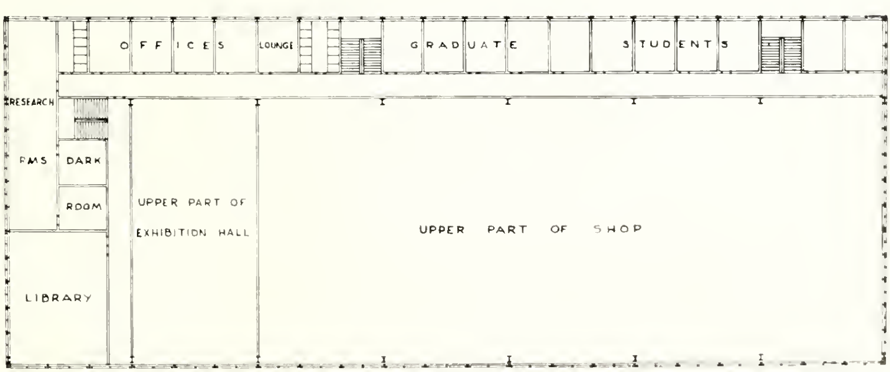


SECOND FLOOR

THE COMMERCIAL APPLICATION OF PHOTOELASTIC ANALYSIS

By
R. E. ORTON
Acme Steel Co.
Chicago

The photoelastic method of stress analysis is now available to the design engineer. Simplification in apparatus and in the technique of model making has reduced the cost to commercial levels. The application has been extended beyond the general analysis of fillets, notches, and other "stress concentrations," to the design of specific parts. The purpose of this paper is to bring to the attention of the reader the possibility of the application of photoelastic analysis to his design work, rather than to give a comprehensive discussion of theory and practice. This latter has already been covered by the writer in a recent series of articles.[1]

The jaw and punch of the band sealing tool illustrated in Fig. 1 is typical of the parts to which this method of stress analysis is applicable. This tool is used to join the ends of steel strapping-band, as shown in the middle portion of the picture. On the right is a band with seal in place and on the left the seal has been closed by the tool. In operation the jaw members force the seal and band up against the punch members. The direction, location, and value of the forces on these punch and jaw members may be determined by elementary considerations of mechanics. However, neither by conventional methods of analysis nor by the theory of elasticity can even a reasonable approximation be made of the stresses set up by these loads. Since these parts fail by fatigue it is not practical to determine the section by trying out a few experimental tools. As a result these devices were tooled up and in the field for almost a year before it was definitely known that they were satisfactory. Even then, if some change were made in the band or seal stock which would increase the load, no definite failure prediction could be made. This frequently led to costly and disastrous results. The application of photoelastic analysis has solved this problem. Over five tools of this type have since been developed and placed in the field with no failure experience whatever. Moreover, failures in a number of old tools have been eliminated.

Typical of another application is the curved link shown with its model in Fig. 2, together with its photoelastic picture in Fig. 3. While a fair

[1] MACHINE DESIGN, March to July, 1940

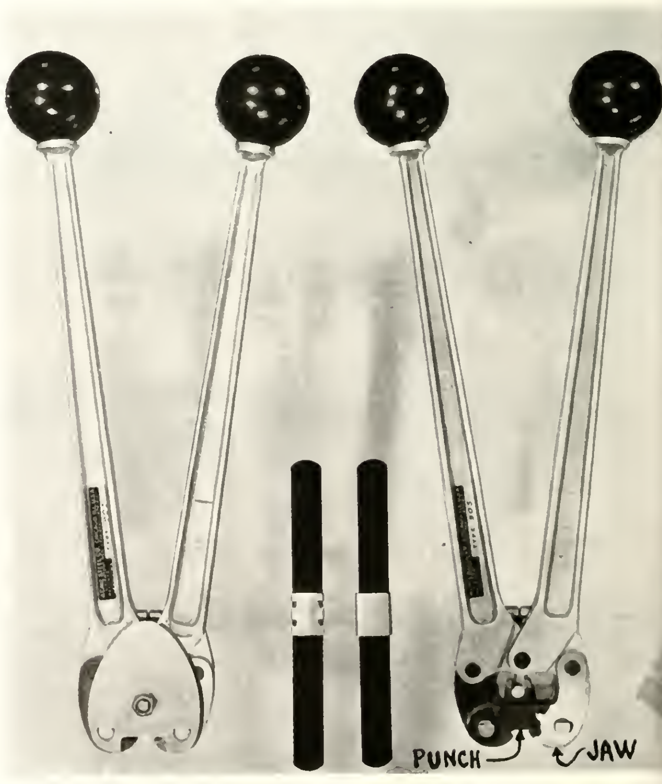
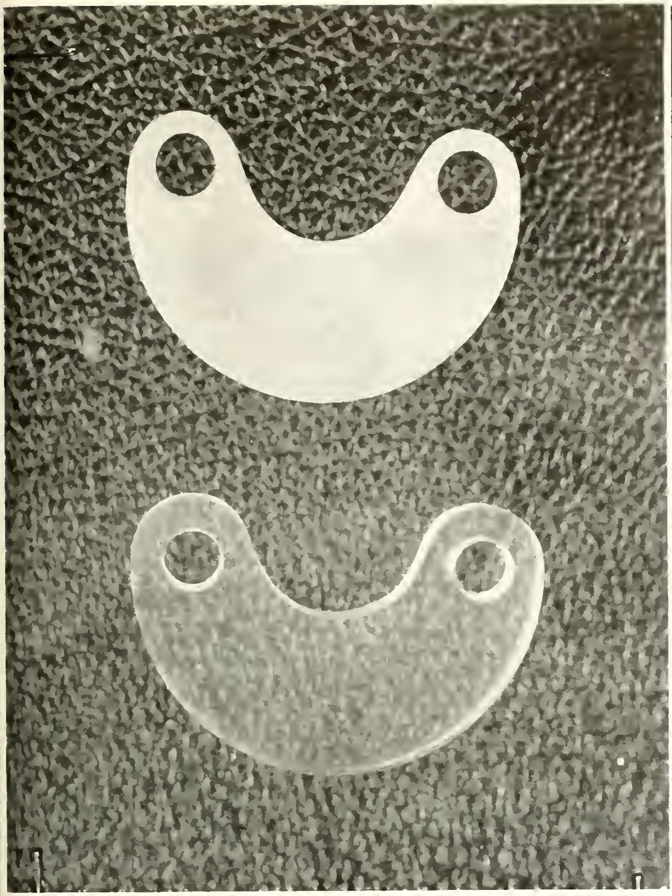


FIG. 1 — Band-sealing tool with sealed and unsealed joint. Cover plate and one jaw have been removed from tool on right to show construction.



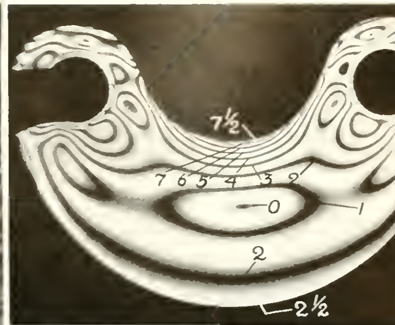


FIG. 2 (Left)—Curved link with its model. Photoelastic picture produced by the loaded model is shown in Fig. 3 (Above).

approximation of the stress in this piece may be obtained by the theory of elasticity, the computations are quite tedious and time consuming. In addition there is always the possibility of an error in long computations of this nature. Photoelastic analysis is a simpler and easier method of determining the stresses.

Three-dimensional photoelastic stress analysis is still in the laboratory stage. The commercial application is therefore limited to plane stress. It should be pointed out in this connection that many cases of three-dimensional stress may be reduced to plane stress, with a superimposed third stress whose effect may be separately considered. O. J. Horger of the Timken Bearing Company has made excellent use of this in his analysis of the effect of press fits on the stresses in railroad axles.[2]

Since essentially photoelastic analysis is an experimental application of the theory of elasticity, a brief introduction to the theory will be given.

Elastic theory is built up on two basic assumptions. First,—there cannot be an abrupt change in stress between two adjacent points; and second,—there likewise cannot be an abrupt change in the strain. The stress distribution in a perfectly elastic material, that is, one in which Hooke's Law is completely satisfied, is built up on these two assumptions with mathematical exactness. This means that the conventional methods of strength of materials, if at variance with elastic theory, are incorrect. It will surprise many to realize that the general theory of beams is based on such assumptions as,—"experience teaches that when a beam deflects . . . any two parallel vertical straight lines drawn on the beam before flexure remain straight after flexure. . ."[3] From this is drawn the conclusion of the lineal distribution of the bending stresses. It so happens that this assumption is sufficiently close to the correct one to satisfy design requirements in the usual case. However, if the member is curved, unusually short, or has any other departure from a straight, relatively long beam, this assumption may be widely in error. While mathematical theory will furnish the correct solution for many special shapes, it becomes impractical on an irregular outline. In this field properly belongs the experimental method of photoelastic analysis.

There are two other essential points to be obtained from elastic theory in order to understand the photoelastic method. The first of these is the variation of stress with change in the direction of the plane upon which the stress is being considered.

Fig. 4 illustrates the general case of stress on an elemental prism oriented parallel to the X and Y axes. There are two normal stresses S_x and S_y, and two shear stresses. Since the shear stresses are equal in value, although opposite in direction of rotation, there are but three stresses to evaluate. Rotation of the elemental prism changes the values of these

[2] "Improving Engine Axles and Piston Rods," METAL PROGRESS, February, 1941.

[3] Merriman's MECHANICS OF MATERIALS, Eleventh Edition, Page 98

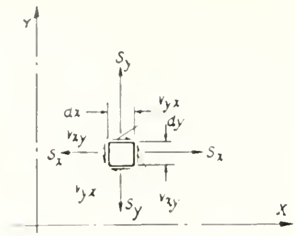


FIG. 4—General case of plane stress on an elemental prism.

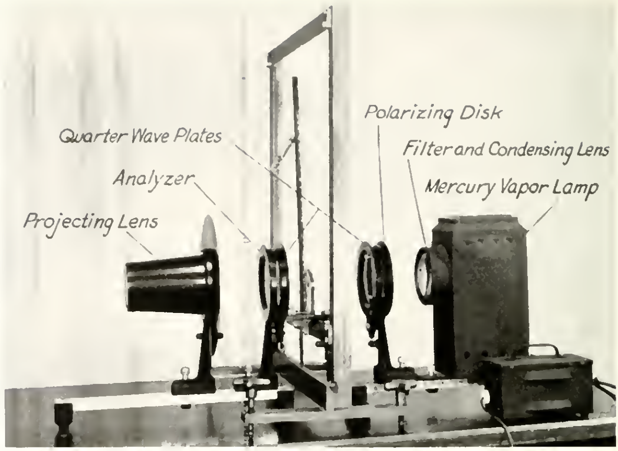


FIG. 6—Polariscope with component parts indicated.

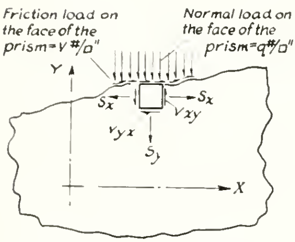


FIG. 5 — General condition of loading and stress on an elemental prism having one face in the boundary.

stresses. Regardless of the initial values, two mutually perpendicular directions will always be found where the shear stress will vanish. These positions of the prism are termed the "principal directions." The normal stresses, which are the same for both positions, are termed the "principal stresses." The principal stresses will be the maximum and minimum normal stress for any direction.

The photoelastic picture is commonly spoken of as a stress pattern. Actually the photoelastic fringes show the difference in the principal stresses, rather than the actual stresses themselves. There are a number of experimental and mathematical methods for determining the sum of the principal stresses. With the sum and the difference the stresses themselves may be determined. However, the use of any one of these methods entails an expenditure of time and energy that is not available for commercial work. Fortunately, knowledge of the stresses within the body is not necessary to determine the strength of a part. For many reasons the stress at the boundary is all that is required. In the usual conventional analysis all that is ever found is the boundary stress. From consideration of the "boundary conditions," the second point to be obtained from elastic theory, the surface stresses may easily be found photoelastically.

The stresses at the surface of an elastic body must balance the applied forces. The condition of an elemental prism with one face in the boundary is shown in Fig. 5. Mathematically the boundary condition states that the normal stress perpendicular to the boundary equals the normal load applied to the boundary, and that the shear stress parallel to the boundary equals the applied shear load. Obviously the above must be true or the prism would not be in a state of equilibrium. The normal stress parallel to the boundary may have any value.

At a point on a free boundary, that is, one to which no load is applied, there is no shear load and therefore no shear stress. The principal directions then are parallel and perpendicular to the boundary. Moreover, since there is no normal load the perpendicular principal stress is equal to zero. Therefore the only principal stress is the one parallel to the boundary. The difference in the principal stresses, then, is equal to the parallel stress. Therefore the photoelastic method determines the stress at any point on a free boundary. The stresses at a point on a loaded boundary may be determined by consideration of the relationship between the principal stresses and the stresses in any other direction.

The optical fringe pattern is obtained by passing polarized light through a transparent plastic model of the part to be analyzed. Fig. 6 is an illustration of apparatus suitable for commercial work. The names of the various parts are shown. Essentially the phenomenon is one of optical interference. Putting it in untechnical language, the light ray at any particular point in the model is split into two components which are then oriented so that one lies along one principal stress and the other lies in the other. If one of the stresses is tension that ray component is speeded up proportionally to the value of the tension. If it is compression it is slowed down proportionally. One ray component will then emerge from the model ahead of the other by an amount which is proportional to the algebraic difference of the principal stresses, and to the length of the path traversed through the model. These two components are then brought together and projected on a screen by means of the lenses shown in Fig. 6. The apparatus is so arranged that it normally brings the components to-

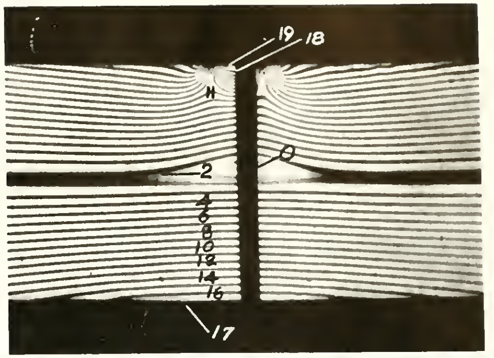


FIG. 7—Simple beam stressed by concentrated load applied with music wire. This is excellent check on accuracy of photoelastic work.

gether exactly half a wave length out of position. That is, if the stress difference is zero the wave components will completely interfere with each other, producing darkness at that point on the screen. If the stress difference is such that the split waves are moved a wave length out of position the light will again be completely destroyed. For any intermediate stress difference light of varying intensity will be produced. If the stress difference is such that the ray components are a half wave-length out of position, maximum light will be produced. Thus each fringe indicates some integral wave-length displacement, and therefore a definite step in the value of the principal stress difference.

The stress difference required to produce one wave-length displacement of the ray components may be determined by loading a simple tension specimen. In such case the principal directions are parallel and perpendicular to the loading direction, and the perpendicular principal stress is zero. The value of the other principal stress is equal to the model load divided by its area. The calibration value per fringe is then obtained by dividing by the number of fringes that appear in the loading.

Fig. 7 is a photoelastic picture of the middle portion of a simple beam under a single concentrated load. The vertical dark band at the center is from the loading wire. The zero point is determined by observation of the development of the picture on the screen as the load is applied. A "zero point" is a point of zero stress-difference and not of zero stress. Sufficient other control points are determined in this way to permit writing in all other fringe values, as has been done on this photo. Knowing the value for each fringe from the calibration it is possible to obtain the stress difference at any point from the fringe number. From the boundary condition the stresses along the boundary are then easily calculated.

The above determines the stress in the model. The question may now be raised as to whether this is the same as the stress in a part of some other material. Within certain limitations, generally of little or no importance, it is. Therefore the stress in a member being analyzed with a full size model is equal to the model stress multiplied by the ratio of the actual load to the model load. If it is a scale model it is necessary to first convert to an imaginary full size model by multiplying the loads on the actual model by the reciprocal of the scale. By a little simple arithmetic the quantitative determination of an actual piece part may be made.

Model material as received is cut across its face similarly to a disc cut from a log. The first step in making the model is to cut out a rectangular block somewhat larger than the final outline. This block is then polished on a metallographic polishing machine using a special sanding paper and finally, metallographic polishing powder. Twenty minutes is usually sufficient to bring the block to the clearness of a piece of window glass.

Annealing is necessary in order to remove initial pattern. Higher temperatures are recommended for commercial work than is common practice in the laboratory. This greatly shortens the time required to anneal and also tends to stabilize the material. Fig. 8 illustrates a semi-automatic

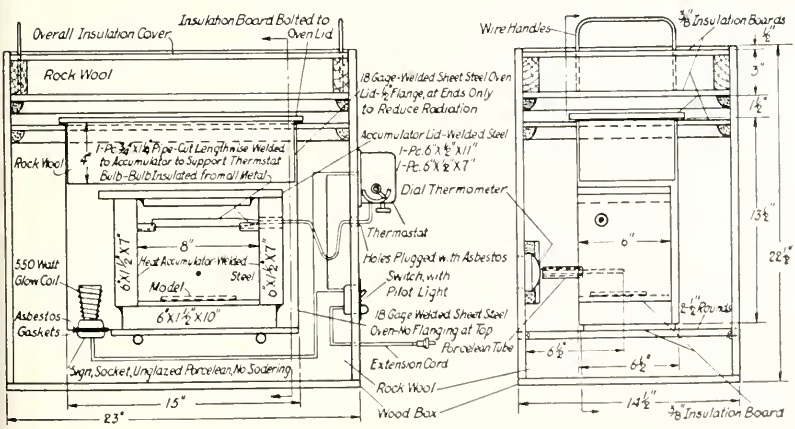


FIG. 8—Construction of annealing oven suitable for treating models for photoelastic analysis.

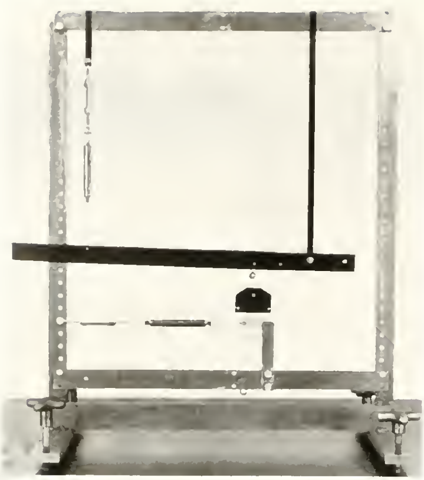


FIG. 9 (Above)—Straining frame with model in place with turnbuckles and spring balances for applying loads.

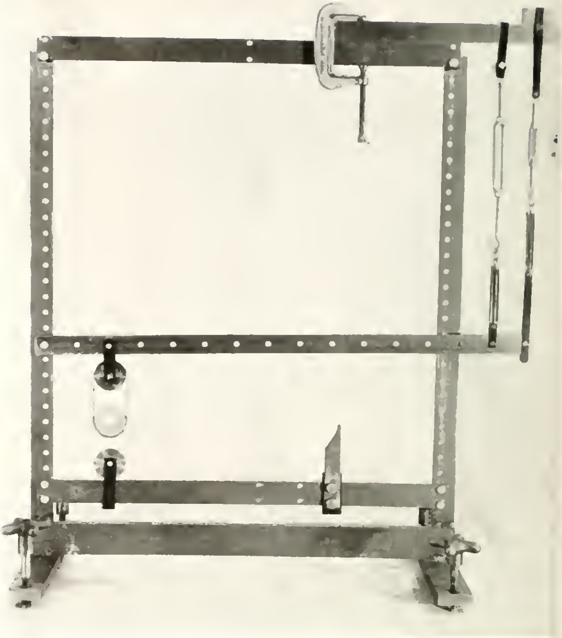
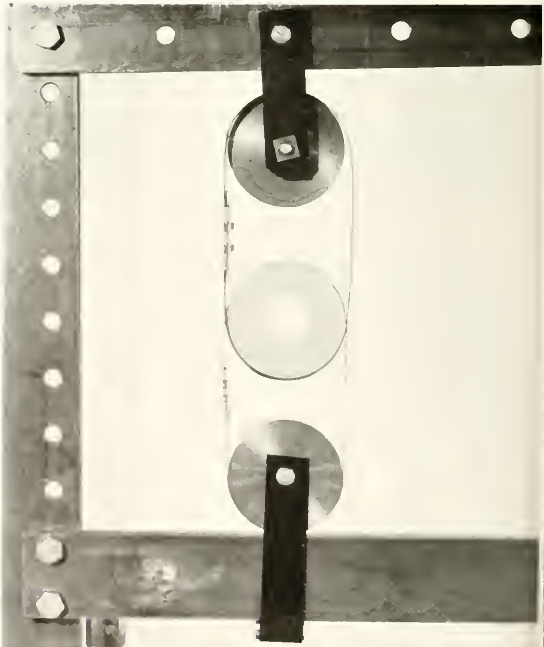


FIG. 10 (Above, Right)—Ring loaded with a uniform external pressure.

FIG. 11 (Below, Right)—Close up of ring of Fig. 10, showing loading bands.



oven that may be constructed at a reasonable cost. The apparatus is so designed that it may be turned on and left for five or six hours to come to temperature, at which time it is disconnected and allowed to cool by itself. The model may be removed in eighteen to twenty hours if needed, although thirty to thirty-six is preferred.

Usual commercial practice in model making is to cut with jig saw to about 1/16 inch outside the final outline, using a fret saw blade. The model is then filed in the jig saw, or milled

on the drill press, to final outline. Holes may be drilled and reamed with the production of little, if any, pattern if the drill is run through at slow speed and kept cool.

An effective and economical straining frame is shown in Fig. 9. Loads are applied with high-grade spring balances through suitable levers and wires. A total of five loads has been applied to the model shown in Fig. 9. Three are measured by the spring balances, the other two are statically determined reactions from these three.

Figs. 10 and 11 are photos of a ring under uniform external pressure. The pressure was secured by the reaction of two thin steel bands, through a rubber liner, against the ring. The bands passed each other at the 180-degree points by means of two slots in the wider band. By this means a pressure of 706 pds. sq. in. was applied to the model. Photoelastic pictures and discussion of the stress pattern will be found in an article on hollow cylinders and shrink fits,[4] part of a series on elastic theory.

It is not necessary to reproduce exactly the actual method of loading, unless the stresses in the immediate vicinity of the load are required. As long as the system applied to the model is statically equivalent to the actual loading, the stress away from the vicinity of the load will be the same. Recognition of this will frequently simplify the setup.

It is good practice to take photos of all analyses. This permits of a check on the original observation and serves as a record for future reference. No special technique is required. Any suitable camera focusing-back, arranged for film pack, will serve. Standard orthochromatic film with tank development is satisfactory. Enlargements of five to seven diameters may be obtained directly on the negative. If desired this negative may then be enlarged several times. Reproductions as high as twenty-five diameters have been obtained in this way. This, of course, requires great care in polishing, focusing, etc. Fig. 12 is a six-diameter enlargement of the crotch of a sealer jaw. The fine fringes are only .001 to .002 inch in width.

This paper would not be complete without some discussion of the commercial importance of possible errors. Unquestionably the most troublesome error is "edge effect." This phenomenon appears to be due to the drying out of the edges of the model, with the production of a pattern. If conditions are right this may merge with the stress pattern, leading to erroneous conclusions. The effect can

FIG. 12—Photoelastic pattern of the crotch of a sealer jaw. Enlargement is six diameters.

be eliminated, or at least greatly reduced, by speed in the handling of the model after filing. The effect is seldom of much importance at low magnifications, the penetration being only .007 to .015 of an inch. Where large magnifications are used to bring out fine detail it may completely obliterate the stress pattern.

Some little discussion will be found in photoelastic literature of the effect of strain and optical creep. It has been the writer's experience that this is of little importance in commercial work as long as the loading is kept within limits and the observations are carried out without excessive delay.

The calibration value changes with temperature. In the case of the Bakelite plastic commonly used this change amounts to approximately one per cent for every ten degrees. The writer's work has been carried out in an air-conditioned room with a fairly uniform temperature. In case of wide ranges corrections can easily be made. The temperature effect is so many times this with some of the other photoelastic plastics that it cannot be ignored.

Experiments indicated that it was necessary to grossly misalign apparatus to produce an appreciable error in the pattern. The same was found to be true of eccentricity of the application of the load. In both cases it was found that when there was sufficient inaccuracy to produce a readable error it was impossible to produce a clear and distinct image.

With the annealing cycle used by the writer the initial pattern is of little commercial importance. It will be more pronounced at lower fringe levels; but since the maximum stress is all that is required this is not important. Reasonable care in the machining of the model, avoidance of extreme changes of temperature, etc., will obviate any appreciable work pattern.

By far the most important item to consider is the fact that our engineering materials are not perfectly elastic, whereas the photoelastic plastics are very nearly so. This means that the results secured from the photoelastic analysis are, within the limits of experimental error, nearly identical with those obtained by elastic theory. The actual stresses produced in the piece part will, however, depart from the theoretical figure. This departure may be considerable in some materials, and in particular under certain conditions of stress. Fortunately, inelasticity causes a reduction in the stress so that the use of the theoretical figure is conservative. Space limits

(Turn to page 52)

[4]MACHINE DESIGN, May, 1941.

THE STORY OF PULLMAN

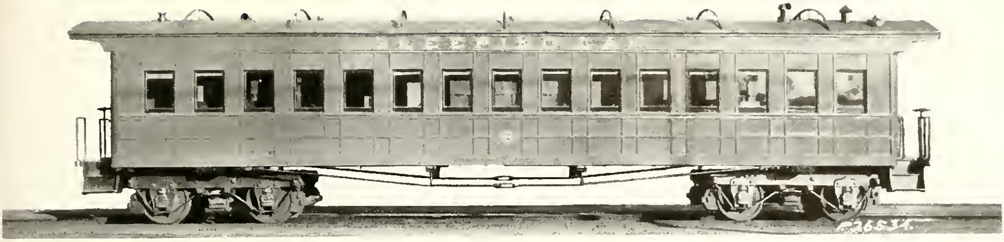
By

GEORGE A. KELLY

Since the year 1864, Pullman has been a synonym for railroad comfort and luxury. To the experienced traveler, it has meant safety, for the interior of a Pullman car is safer than a home. To both experienced and inexperienced, Pullman calls to mind interesting companions and the opportunity of knowing people from varied places and professions. The historian of the American railroad will add other contributions. The first Pullman sleeping cars directly influenced adoption of a standardized track gauge, an advance as indispensable to efficient shipment of freight as it is to convenient passenger travel. Equally important was an indirect but constant pressure brought upon all railroad lines to increase the size, comfort, and safety of passenger coaches.

These essentials of modern traveling resulted primarily from the vision and perseverence of one man. This man, George M. Pullman, gradually transformed and brought to perfection the crude sleeping car of his youth. Later, his advanced operating methods led to the long distance routing of Pullman cars over short connecting lines, and instead of a series of irritating changes, made travel by

The First Lightweight Streamlined Train.



Old Number 9. Originally a Coach. Rebuilt as a Sleeping Car.

rail continuous. Where the traveler once purchased new tickets and changed trains every few hundred miles, he now could ride from Washington, D. C., to San Francisco with one ticket and in one sleeper. From George M. Pullman and the organization which he built came the "hotel" car, a combination sleeper and diner; the palatial separate diner; and the luxurious parlor car. Pullman inventiveness added the vestibule which made possible safe passage from coach to coach. Subsequently, the company built the first all-steel car, and the speedy, light-weight streamlined train which delights the modern traveler.

March 3, 1831, the date of Pullman's birth, coincided closely with that of the American railroad, and anticipated by six years the first sleeping car. At the age of twenty-two, in the year 1853, young Pullman made his first sleeping car trip. As he and his fellow-passengers tossed on their uncomfortable bunks, he resolved to build some way, and some day, a car which would serve for both night and day travel, and be comfortable at all times.

Since the advent in 1837 of the railroad sleeping car, nothing more than incidental improvements had been made. The general plan remained similar to that used in the first sleeping car built in America. This car, which ran over the Cumberland Valley Railroad between Harrisburg and Chambersburg, was merely a reconstructed day coach. Along one side, three compartments were built, and in each compartment three bunks were placed. The base of the seats formed the lower tier; the seat back, when elevated horizontally, the central berth; the upper was lowered from the roof. The railroad provided the mattresses, and the passengers the bed clothing. Many passengers made blankets of their coats, and not a few slept with boots on. Light came from candles, and heat from box stoves burning either wood or coal. The limited toilet facilities consisted of basin, towel, and water located at one end of the car.

The bunks of the early sleeping car doubtless were an imitation of those found in canal boats, once the major competitor of the railroad. On the smooth water of the canal, such accommodations proved fairly comfortable, but in railway cars that jolted and swayed over a dirt roadbed, they were quite the opposite. Indeed, every short rail brought its own disconcerting bump. It is little wonder that an inventive mind saw the pressing need for improvement, and resolved to provide this when circumstances would permit. So it fell out that when several successful engineering undertakings had brought reputation and some capital, Pullman turned his attention to the plan for a better and more comfortable sleeping car.

In 1858, the inventor engaged Leonard Seibert of Bloomington, Illinois, to remodel two coaches purchased from the Chicago and Alton Railroad. From the dozen cars which then constituted the entire passenger equipment of the road, Pullman and Seibert selected numbers 9 and 19. These harbingers of luxury travel, flat-roofed as were box cars, were only forty-four feet long. Each had fourteen single-sash windows, with the glass approximately a foot square. Into these cars, slightly more than six feet in height, the builders fitted ten sections, a commodious linen locker, and two washrooms, one at each end. On September 1, 1859, the first Pullman made the run from Bloomington to Chicago, carrying the inventor and four passengers.

The washrooms placed at each end proved but one of four innovations still in use. The second change was the employment of two rather than three berths to a section. As improved in 1864, the upper berth swung on a hinge from the side of the car. When the bedding from both berths was placed in the upper, and the seats restored to their normal position, the sleeper became a day coach in which no space was wasted on a storage locker. The time and energy required to carry bedding to this locker also had been saved. The two first Pullman cars, richly upholstered in plush, cost approximately $1,000 each. They were heated with box stoves, lighted by oil lamps, and mounted on four wheeled trucks. The brakeman made up the beds.

In the year 1864, plans were completed for the construction of a sleeping car radically different from the twelve coaches previously built. This first Pullman-built car was constructed in Chicago at a cost exceeding $20,000, a sum four times greater than that previously expended on a railroad coach. With this car began the famous practice of supplying each

Pullman with a name. Quite aptly, it was called the *Pioneer*. Following the *Pioneer* came the five sleeping cars which in 1866 ran over the Chicago, Burlington and Quincy Railroad, the *Atlantic*, *Pacific*, *Aurora*, *City of Chicago*, and *Omaha*.

The body of the *Pioneer* rested upon improved trucks with springs reinforced by solid rubber. It stood a foot wider than any previous railroad car, and two and one-half feet higher. Within the enlarged interior were tastefully upholstered seats, hardwood finish, and beveled mirrors, together with comfortable mattresses and spotless bed linen. The added width not only made berths more comfortable, but made possible occupancy by two passengers. The hinged upper berth, which folded toward the side and top of the car, necessitated the higher roof. With the higher roof came additional comfort for the passenger.

Nothing shows better both the courage of George M. Pullman, and his determination to build right, than the increased width and height of the *Pioneer*. With the exception of length, the dimensions of the *Pioneer* were those upon which subsequent and present-day cars have been constructed. At that time, however, bridge and platform clearance would not permit use of the car on any railroad. For some months it appeared that the inventor had wasted his capital on a useless showpiece, but fate unexpectedly intervened. In April, 1865, the remains of the martyred Abraham Lincoln were brought by special train from Washington to Chicago. For the last stage of the journey to Springfield, government officials desired to use Pullman's new car. The Chicago and Alton Railroad made the alterations of bridges and station platforms necessary for its employment, and this employment in turn made known its unprecedented elegance and comfort. Shortly thereafter, Pullman width and height became more and more the standard for car construction.

With an ever-increasing number of travelers making extended journeys in Pullman cars, the problem of obtaining meals grew acute. This need was promptly met by the *President*, a combination sleeper and diner long known as the "hotel sleeping car." From a kitchen placed at one end, meals were served on tables placed within the sections. From the first, an attempt was made to provide a menu of some variety at a price consonant with the cost of such service. An 1867 bill of fare included oysters, cold and broiled meats, eggs, Welsh rarebit, pickles, coffee, and tea. The third and the final sections of the menu offered the hungry traveler:

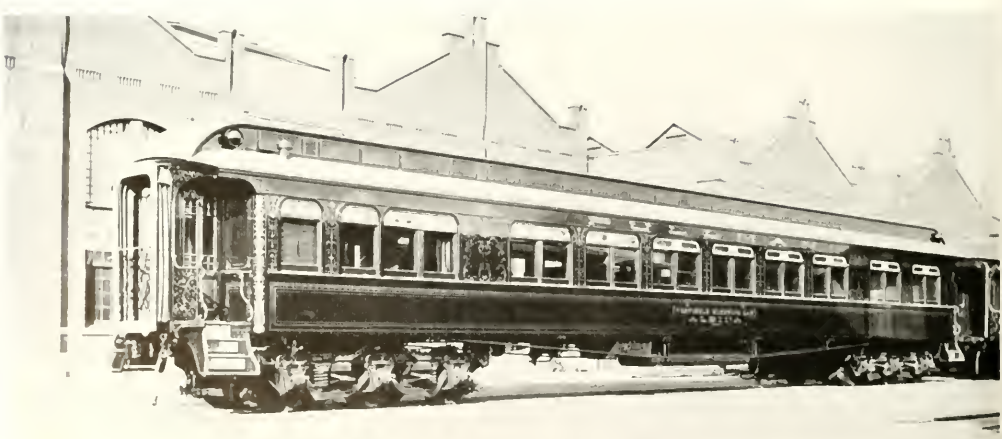
Beefsteak, with potatoes....	60
Mutton chops, with potatoes	60
Ham, with potatoes........	50
Welsh rarebit	50
French coffee	25
Tea	25

During this year, the Pullman Palace Car Company was incorporated to manufacture and operate sleeping cars. The Company also began to establish a system which provided the public with cars of uniform construction suited to the needs of night and day travel, and in addition carried passengers without change over different railroads. The operating personnel should consist of responsible employees to whom children and women might be entrusted. Assisted by such a personnel, and with no change in cars required, children, women, and even invalids could safely travel alone.

The important year of 1867 likewise saw Pullman achieve the first non-change trip from Chicago to New York. Heretofore, the different track gauges used between these cities had made a continuous journey impossible. But during this year the Great Western Railroad of Canada added a third rail to its narrow-gauge track, and opened through communication between Chicago and New York. Fittingly, the first Pullman to make this trip was the *Western World*. In keeping with the *President*, the *Western World* was the new combination "hotel sleeping car" demanded by through transportation. The year following, 1868, saw the first true dining car placed in service on the Chicago and Alton. This car, designed by George M. Pullman, was entirely given over to the preparation and serving of food. With complete appropriateness, it bore the name *Delmonico*.

The early years of the next decade saw a further addition made to travel comfort. This addition was the parlor car, first built for use on the Midland Railway of England, and in 1875 introduced in the United States. As the dining car had developed from a com-

The First Vestibule Car.



The First Steel Car.

bination sleeper and diner, so the parlor car of today evolved from a coach which was part sleeper and part individual chair car. The *Maritana,* first "reclining-chair" or parlor car used in America, provided the public with individual chairs heavily and richly upholstered. Placed in two rows before the windows, the chairs revolved on swivels so that they faced in any desired direction.

With its establishment of separate sleeping, dining, and parlor cars, the Pullman Company had set up the three major types of luxury railroad coach so long known to the modern traveler. During the decades of their use, these types showed almost kaleidoscopic changes in interior decoration. There were ornate carving, delicate marquetry, and lavish lacquer work, each and all characteristic of the shifting styles of the several periods, while upholstery and draperies also ran riot in color and design. By the turn of the century, simplicity in decoration was the rule, with a more harmonious blending of colors. This practice largely prevails today.

The tale of Pullman's artificial illumination is a story of general progress and of individual pioneering. Beginning with the conventional candles, the company turned quickly to oil lamps. Next came the more brilliant Pintsch gas, and ultimately electricity. This final advance was not introduced in America, but rather in England, where electric lights were installed October 14, 1881, on an experimental coach running on the London, Brighton, and South Coast Line.

The experimental car carried beneath it thirty-two small metal cells, each of which contained lead plates coated with red oxide. Suspended from the ceiling were twelve small Edison incandescent lights of the bamboo filament type. The light flickered unevenly, but it filled the coach, and lasted throughout the return journey from Brighton to Victoria. The elementary storage battery required charging each night preceding its use, but nevertheless served its purpose well. There came also the idea that electricity to charge the battery might be generated by utilizing the energy of the moving train, and from this idea evolved the powerful axle-driven generators in service today.

Heating likewise showed steady progress from crudity to perfection. Wood and coal-burning box stoves gave place to hot-air furnaces; then came the hot-water system, and ultimately low-pressure vapor heat. The heating of a complete train by steam drawn from the engine was tested in 1887, and put in operation the year following. This improvement abolished independent car-heaters, and by so doing removed a major source of discomfort. The present century brought air-conditioning, undoubtedly one of the greatest boons ever developed for railway travel. To be sure, air-conditioning experiments began as early as 1854, but its first successful operation was inaugurated by Pullman in 1929. Today finds practically every car of the system air-conditioned.

A further contribution to rail transportation resulted from a necessity which progress had imposed. Through travel first demanded the "hotel sleeping car," and subsequently the separate diner. But use of the diner often involved a dangerous passage across open car platforms. Platform enclosing devices were patented and constructed, but none proved practical, with the result that in 1886 George M. Pullman set out to devise a system which made a train both continuous and sufficiently flexible in connecting platforms to allow for car motion and sway when rounding curves. The solution proved to be the car vestibule. As first designed, the vestibule provided a closed passageway, and did not extend the full width of the car. Its basic innovation consisted of elastic diaphragms on steel frames attached to the ends of each car, and so arranged that when the train was made up, the faces of the diaphrams were held firmly in position by powerful spiral springs. The vestibule not only eliminated the danger and inconvenience of crossing from car to car, but largely eliminated car oscillation. By reducing the possibility of adjoining cars being telescoped in a wreck, it increased measurably the safety of travel. In 1893, the vestibule was extended to the full width of the car.

Early in the present century, Pullman began experimentation with the steel car. During 1907, the first car of this type was completed and put into operation. Three years later, this equipment went into regular service, and the number of steel cars increased steadily. For the lamentable reason

that wrecks were not the rare exception that they are today, the superiority of the steel over the wooden coach became too quickly apparent. The American railroad soon turned to the steel car, and the traveling public had such protection as it had never known before.

Steel cars meant increased weight as well as increased security. The additional weight first necessitated heavier rails and a superior roadbed. Secondly, it directly affected hauling costs by demanding greater power for equal speed. But the strength brought by steel had to be preserved, and as a result, car builders sought materials which would reduce weight without sacrificing strength. After years of experimentation, success was attained by the use of aluminum and steel alloys. Pullman again stood at the fore, and built for the Union Pacific Railroad the first light-weight, all-streamlined train. On February 12, 1934, this train started regular operation, and brought with it a rebirth of interest in railway travel. Both the increased use of this type of railway equipment and the contribution of Pullman to the field are indicated by these simple facts. Up to February 1, 1941, the company had built more than seventy per cent of all light weight passenger cars ordered from the industry. All told, 1,578 cars were constructed, 1,122 of which went to railroads, subways, and to interurban lines.

All types of Pullman accommodations may be had on the light weight train, ranging from the always popular section to individual rooms of the latest design. Early in his car-building experience, George M. Pullman realized that some passengers would prefer a private room, and this he provided. First came the stateroom, now called the compartment; then the more commodious drawing room. As the first combination diner and parlor services had brought demands for cars devoted exclusively to each, so was the case with individual room service. In 1927, the Pullman Company built a car for overnight journeys containing single rooms and stationary beds. The single room later developed into the double bedroom, and provided both an upper berth and a sofa that became a bed.

Our latest trains carry Pullmans whose compartments and drawing rooms have been improved by additional facilities and by rearrangement. There now awaits the traveling family either a double bedroom, or a master room whose two beds fold into the wall, and during the day give place to four lounge chairs. The single traveler may choose the roomette, also with a bed which folds into the wall, and a lounge seat for day travel. The "duplex" provides either a "downstairs" or "upstairs" room, each with a convertible sofa bed. All rooms have individual regulation of light, heat, and air-conditioning, together with lockers and private toilet facilities. Many trains carry a restaurant-lounge car that serves meals, and not only has seating accommodations, but sometimes rooms and sections as well. The final car of the train may be a luxurious observation lounge where the traveler may read, watch the passing landscape, or enjoy conversation and refreshment with his companions.

A subsidiary of Pullman, the Pullman - Standard Car Manufacturing Company, not only supplies the needs of the parent concern, but fabricates passenger and freight equipment for railroads, subway rolling stock, and motor buses. The company itself operates eight thousand cars under contracts with railroads in the United States, and in portions of Canada and Mexico. The operation of these cars is perhaps its greatest contribution to travel that is both luxurious and inexpensive. Many of the railroads served require the greatest number of sleeping and parlor cars during the summer months. Other roads, particularly those which carry tourists to the South and Southwest, need increased service during the winter. Such special occasions as large conventions call for the addition of scores of sleeping cars to those roads which must bear the bulk of the traffic. Great concentrations of cars also are essential for the movement of government troops. No one railroad company could handle such demands both efficiently and at a reasonable cost.

These and other pressing demands the Pullman Company has sought to meet for more than three-quarters of a century. Its success in this effort has resulted from many factors, but among those most important is the motto: "Progress Without End."

Roomette Car.

CHICAGO'S BRIDGES

By
OTTO W. HANSEN

HISTORY

Chicago's site was built during the glacial period. When the ice retreated it left the St. Lawrence River, the Great Lakes and the streams which flow into them.

This system of waterways extends from the Atlantic Ocean to within a few miles of the Des Plaines River. Along this natural route of travel came explorers, traders and settlers who peopled the Mississippi Valley.

Before the advent of the railroad, however, the waterways formed an avenue of communication so important that we of today can hardly appreciate it. The idea of connecting the Chicago River with the Des Plaines River by means of a canal was advanced by the first white explorer who visited the site of Chi-

The Chicago River. A Few of Chicago's Fifty-Six Movable Bridges.

Chicago Tribune Photo

The Chicago River. A Century Ago.

cago. The two streams are only a few miles apart, and the water-shed which separates them is only a few feet high.

These two waterways were connected with each other, first by the Illinois and Michigan Canal in 1848, and a second time by the Sanitary Canal in 1900. Now the projected development of the St. Lawrence Seaway and the Lakes to Gulf Waterway maintains this question as a matter of prime importance to Chicago's future.

As Chicago's topography is flat, and only a few feet above water, it became necessary from the very beginning to provide movable bridges to permit the passage of vessels.

With the movable-bridge policy early established it becomes evident that the story of these bridges is the story of Chicago, as it has been closely interwoven in the fabric of this metropolis which in 100 years has developed from a frontier post to a great city of 4,000,000. The important part Chicago's bridges have played in the consolidation of the sections of the city, separated as it is by its rivers, into one homogeneous community is manifest to anyone after a little thought.

The first pedestrian bridge was constructed at Kinzie Street in 1832. The first swing bridge for vehicles and pedestrians was built at Dearborn Street in 1834. All early bridges were of timber; their costs were defrayed from subscription funds. The first municipally built bridge was constructed in 1857 at Madison Street, costing $30,000. The first iron bridge in the west was built in 1856 at Rush Street, Chicago.

With but a few exceptions up to 1890 all bridges were of the horizontal-swing type, supported by a pier in the center of the river and in most cases were manually operated. This type reached a high degree of perfection. One objectionable feature was the restricted use of the river caused by the center pier which made the most desirable part of the waterway useless.

In 1894 a vertical-lift bridge was built at South Halsted Street. It operated as an elevator, with steam power. It did not meet with favor, being costly in construction, unsightly and uneconomical in operation and providing poor operating visibility. In view of the dissatisfaction with this type other designs were developed to meet the demands for increased and unobstructed waterways.

From 1892 to 1900 the construction of the drainage canal was in progress. The proposed flow requirements affected bridge design to the extent that proper waterway had to be furnished to avoid currents which might be detrimental to navigation. Water diversion through the Chicago River was regulated by order of the Secretary of War for many years. After January 1, 1940 this flow was materially reduced so that at the present time provisions for water flow are inconsequential.

Early Bascules

Going back to the conditions in the early nineties, after the Halsted Street lift bridge had been in operation, a rolling-lift bascule bridge was developed by Mr. Wm. Scherzer and was constructed at Van Buren Street in 1895. Its movable leaves are integrally supported on a vertical circular girder the circumference of which rolls, when the bridge is to be raised, on a horizontal foundation a distance of twenty to thirty feet, much as a rocking chair rolls on a floor.

As replacement of many of the bridges was imperative between 1894 and 1907, twelve of these rolling-lift bridges, and six trunnion-bascules were built, mainly at locations where the old bridges impeded the flow of water for sanitary purposes.

Bascule means "see-saw", a double-arm cantilever mounted and balanced on a shaft, the trunnion, on which it my rotate. This principle was used in the construction of the ancient portcullis bridging the moats around castles and forts. Its application to large structures which can be raised and lowered, and of sufficient strength and capacity to meet the traffic requirements of a large city involves considerable engineering ingenuity.

The famous Tower Bridge of London was one of the first large trunnion-bascule bridges to be built, being completed in 1894. Chicago's Van Buren Street rolling-lift bridge was completed in 1895. It naturally followed that local engineers would observe their performance to determine their relative merits.

After several years experience with rolling-lift bascule bridges, it was decided that the trunnion-bascule appeared to be more suitable for local conditions. As a result, competitive designs for a bascule bridge at 95th Street over the Calumet River were invited in May, 1900. A committee of three bridge engineers selected one of the City's own designs, with modifications. This design fundamentally is the type used today not only in Chicago but in several other cities and is known as the "Chicago Type Bascule".

The 95th Street bridge is double-leaf with three trusses 21'-0" c. to c. pivoted about three trunnions. The span is 128 feet c. to c. of trunnion bearings with cast-iron counterweights under the fixed approach. The substructure consists of a front and rear pier connected by walls so as to form watertight counterweight pits. Girders parallel to the movable trusses supported on the front and rear piers carry the trunnion bearings. The main operating pinions for operating

the bridge mesh with racks fastened to the curved heels of the three trusses. At the center the leaves when closed are connected by motor-driven shear-locks.

The committee's reasons for favoring the trunnion type of bascule are given in their report as follows:

(1) "Constant point and direction of application of load on the foundation whether the bridge is in motion or is stationary." (On a rolling-lift bridge the load moves back as the bridge opens and may cause instability of foundations.)

(2) "Reduction of the number of moving parts to a minimum."

"The bascule design permits the placing of the center of gravity of the moving bridge in the trunnion axis or its proximity. The placing of the center of gravity a short distance from the axis of the trunnions toward the draw opening and the arrangement by which the tail end is relieved from any possible live load has the advantage of holding the bascule firmly in position when closed without absolute necessity for heel-locks. There is no tilting effect due to the action of live load coming on the bridge."

Forty years later and after about $50,000,000 worth of local bascule bridge construction, we note that these early recommendations, which were not all then accepted, have been incorporated in present design. Several of the suggestions were:

"—that adjustable resting blocks be placed in front of and near the trunnion so that when the draw closes, the load may be transferred from the trunnions to the resting blocks."

"—for future and more important structures, warranting additional expense, foundations should be carried to bed rock."

"The design of the piers is not satisfactory, — make one counterweight pit by disposing of the partitions—"

In the main the above description of the 95th Street bridge is an excerpt from an article by Mr. Earle G. Benson, Mechanical Designing Engineer for the Bridge Division, which appeared in The Armour Engineer of March, 1931.

The Halsted Street Lift Bridge
Built in 1894.

Modern Trunnion Bascule

A fundamental departure from the above recommendations and one embodied in practically all the later designs is the distribution of the weights of the movable leaf in such manner as to have the center of gravity of the entire leaf coincide with the center of the trunnions. This feature results in balanced equilibrium of the leaf, exclusive of applied loads, as snow and wind, in all positions of the arc of travel.

In cooperation with the Chicago Plan it was imperative to consider the aesthetic features of the bascule bridges. While the fundamental principle of design which placed the counterweights below the roadway was established in the 95th Street type of bridge, further improvement in appearance was obtained through relocation of the operating rack. This was built into the truss internally. An internal operating pinion was provided and the machinery was placed alongside the trusses. This construction permitted greater latitude in the design of the movable leaves so that variations in appearance could be obtained when so desired.

Abnormal operating conditions require, as insurance against breakdown, great ruggedness and conserva-

Ninety-Fifth Street Bridge: 1905.
3-Truss, External-Rack Trunnion Bascule.

tive design. With the increase in loads, widening of roadways and greater length of spans it followed that the size of the component parts of the bridge naturally developed into a greater massiveness. The combination of engineering functions together with features of beauty, sometimes termed "functional beauty" developed ultimately to such a point that the bascule bridge at Wabash Avenue in 1930 won the first award of the American Institute of Steel Construction for the most beautiful steel bridge constructed during that year.

The modern bascule may be described substantially as follows:

The foundation, a watertight massive-walled concrete box, provides support for the trunnions and accommodates the rear part of the movable leaves and counterweight box. It rests on caissons of 6 to 8 ft. diameter reaching down to the rock from about 60 to 107 ft. below City Datum. The vertical loads run up to 1000 tons. The pit floor is about 20 ft. below water level and thus the resulting uplift and sidewise earth and water pressure must be duly considered. The counterweight must be free of buoyant effects from water and therefore the pits must be watertight.

The superstructure consists of two movable leaves and their supports, the fixed approaches, the machinery and the houses. Each leaf is a huge cantilever arm of over a hundred feet; in closed position the effect is that of a flat arch; in open position the roadway serves as a barrier protecting traffic. Uniting the trusses, behind the trunnions and under the approach floor, is the counterweight box.

The superstructure is designed for dead and live loads. Fifty ton street cars, 24 ton trucks, 100 lbs. per square ft. uniform moving load and 20 lbs. per sq. ft. wind load are assumed. Proper allowances are made for impact and vibration. Closed and open positions are considered and change in the character of the stresses is taken into account.

The roadway of the bascule bridge offers a different problem from that of the ordinary fixed bridge. It must remain in place when the leaf is vertical; it must be light in weight, yet substantial.

Equipment

One operator's house is provided for each leaf, on opposite sides of the river, with a bridge operator for each leaf. Proper visibility is of importance in the design of these houses. Usually a bridge house is from three to five floors high with suitable architectural treatment. It houses heating equipment, electrical resistances, relays, and controllers, sanitary facilities and operating supplies. The operating room occupies the entire top floor with a commanding view in all directions of river and street traffic. This is possible through the provision of windows all around. The operator regulates the bridge from this station through the controllers on the brakes, motors, gate-signals, center and heel locks, in a definitely prescribed order. Neon "Stop" signs, electric bells, and one locomotive bell on each house are provided. These signals are interlocked with the center shearlock and the power circuit used for moving the structure, so that before the operator can move the bridge it is necessary that all the signals be in their proper position and on display to traffic. If for any reason trouble is experienced in this primary circuit, he is then required to resort to the use of a secondary auxiliary circuit which is not governed by the interlocking features.

In the event of failure of both these systems, the operator is required to signal the oncoming vessel to stop by means of a red flag by day and electric light by night. Ordinances limit the speed of vessels so that such an emergency can be met.

The control of a heavy bascule bridge in every position, and safe and quick operation, require efficient machinery. The almost perfect balance attained today necessitates motive power only to overcome inertia, friction of moving parts, wind and snow loads.

In the design of the machinery many factors are considered. In addition to static conditions, the stresses from the kinetic energy of the moving masses are transferred to the gear train; in case of failure, to the bumpers and live-load pedestals. Trouble may develop in the machinery, or expansion castings may bind, necessitating extraordinary force to move the bridge and putting heavy pull on the machinery. The most unfavorable condition is assumed to be covered by the 20 lb. per sq. ft. unbalanced load on the leaf. This is the design criterion for the machinery.

Ordinarily carbon-steel forgings and castings are used for machinery parts but with the increase in the size of the newer bridges its use would result in machinery too bulky and impractical. As for example, with trunnions often three feet in diameter and nine feet long, the tendency is towards use of high-strength alloy steels. The machinery is mounted on bed-plate steel castings, although welded construction is resorted to on occasion. The driving power for the larger bridges is two 100 H. P. 600 volt D.C. motors per leaf.

In some instances compressed air and hydraulic devices are used for operating signals, brakes or other appurtenances.

Miscellaneous

On several occasions the use of vertical-lift bridges as means of meeting extraordinary conditions have been considered but invariably these studies reverted to the acceptance of a bascule design. However, skewed river conditions encountered at the Torrence Avenue crossing over the Calumet River, together with the long span, indicated the advisability of the use of the vertical-lift bridge, which was completed in 1937.

Besides the fifty odd movable bridges built by the local governments, railroads have built eight bascule and four lift bridges over the Chicago and Calumet rivers within the City Limits.

Wabash Avenue Bridge. Trunnion Bascule Type.

Award by American Institute of Steel Construction for Most Beautiful Bridge Erected in 1930.

Construction

The scope of this article does not permit of proper discussion of construction methods used in the erection of a bascule bridge. It may be of interest to note that eighteen months are required to complete the construction. Also that during that time traffic is diverted over a temporary bridge, or sometimes over the existing swing bridge. The change-over from the old to the new bridge is generally accomplished with only a few days inconvenience to traffic.

A short time ago bids were taken for the substructure portion of a new bridge at State Street to replace a thirty-five-year-old rolling-lift bascule. The replacement of this bridge resulted from the construction of the State Street subway.

Another rolling-lift bridge, also about thirty-five years old, at Canal Street near Cermak Road is to be replaced shortly with a modern bascule.

From these instances, some idea of the "life" of a bascule bridge in Chicago is obtained.

Maintenance

With forty years assumed life of a bascule and with a system of fifty-six movable bridges, it follows that replacements should be at the rate of about three bridges every two years. From 1900 to 1927, rapid and wide change in traffic requirements, together with periods of economic stress, gave rise to many complex maintenance problems.

After 1922 the depression stopped new bridge construction and lowered the standard of maintenance. Conditions reached such a stage that in 1928 a bond issue of $1,000,000 was passed by the voters for the modernization of nine bridges for which rebuilding was not required and for which funds were not available. The main factor in this situation was the light floor system, designed for the lighter and slower horse-drawn vehicles and not able to cope with the modern heavy and fast-moving traffic. The new floors were stronger and heavier, entailing additional counterweight, all of which added about 100 tons to each leaf. This, together with the increased loadings and the fact that some of these structures were thirty or more years old, and badly

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BEHIND DEFENSE

By

KANARDY L. TAYLOR

As these words are written a military parade is passing by below my window on the Avenue—martial music, uniforms, flags, guns, thousands of young men trained in the art of defense, that burning question in our minds today—reminiscent of twenty-five years ago.

Today, however, there is a difference. The front lines are not limited. The front lines of defense today include our manufactures and transportation, our agriculture and mining, our entire industrial set-up. And in all of these our prime movers are our engineers and trained technicians: electrical, mechanical, chemical. And behind the engineers are long years of study, hours upon hours spent in the library with books and magazines, theses and reports, documents and dusty records.

Though perhaps not so romantic as parades, today the libraries of our

General Reading Room: The John Crerar Library.

country are feeling their new importance, especially those devoted to, or having special collections of, the pure and applied sciences.

Located at one of the busiest corners of the world, at Michigan Avenue and Randolph street, stands an institution little known, or entirely unknown, by the man in the street. From the outside the fifteen-story stone-front building looks little different from any of its neighbors standing stiffly about in their cold dignity. Inside, however, is housed the priceless collection of one of the world's finest and most complete scientific and technical libraries. Far above the blatant noises of the street are three large quiet reading rooms filled with assiduous students rubbing elbows with engineers, chemists, doctors—men of repute who are leaders in their respective fields.

Through the office and reference departments flow hundreds of letters from every state in the Union, from Canada, Mexico, South America; letters from individuals, from industrial companies, from state and federal government agencies, from private, public, college and university libraries. Some ask for information on specific questions, some ask for selective bibliographies on given subjects, and the libraries usually ask for a loan or a photostat of the highly technical material which they themselves are unable to supply to their readers. The entire building is a beehive of scholarly activity and research.

But, all of this was not always so. The John Crerar Library grew to its present stature from a humble beginning on the rented sixth floor of the old Marshall Field Building at the corner of Washington Street and Wabash Avenue in the year 1895.

Mr. Crerar, who was for many years a prominent citizen of Chicago, was born in New York in 1827; he was educated there, and there entered business. In 1862 he came to Chicago and established the firm of Crerar, Adams & Company, dealers in railroad supplies. He died October 19, 1889.

Besides specific bequests made to relatives, friends, and charitable and public institutions, he provided by his will for the "erection, creation, maintenance, and endowment of a free public library . . . for all time." The amount thus bequeathed was estimated at the time to be about $2,500 000.

It was arranged by Mr. Crerar, who made the first appointments in his will, that the management of the Library should be controlled by a board of fifteen members, two of which, the Mayor and Comptroller of Chicago, were to be ex-officio members.

As a result of a series of conferences with the trustees of the Chicago Public and the Newberry Libraries it was decided that the special field of the John Crerar Library should be that of the natural, physical, and social sciences, and their application, thus supplementing the existing and prospective collections of Chicago.

And so, after a definition of the scope of the future collection, immediate action on organization was commenced. Mr. Clement W. Andrews, then Librarian of the Massachusetts Institute of Technology, was elected by the Board as the first librarian. After weeks of preparation, including many conferences and visits to various established libraries in the East, Mr. Andrews chose his staff and the real beginning of the Library was made with the entry of the first book on February 13, 1896.

More than 8,000 volumes, including practically the entire collection of Natural Sciences and Useful Arts of the Newberry Library, were transferred to the John Crerar, constituting in 1896 the first important purchase.

The crowds of visitors, during the first three days set aside for inspection after the Library was officially opened to the public in April, 1897, proved the wide-spread interest of Chicagoans in their newly established free public reference library. That first year the total attendance was 18,584, or a daily average of 80; in 1940 total calls for books were 354,223 with a daily average of 1169. Then our book stock stood at 29,141; today it has passed the 650,000 mark.

From that time on it is a story of rapid growth and expansion. In addition to the regular trade books, special collections were acquired through the following years, including the famous Ely library of economics and sociology, the Gerritsen collection on finance, labor, and general sociology, the transfer of the Medical Department of the Newberry Library and of the Senn collection on surgery and physiology, the Martin collection on gynecology and obstetrics, and the Levasseur collection of maps.

A building fund had been provided by the Directors from the beginning, and by 1911, the Library having grown to occupy several floors of the Marshall Field Building, it seemed that the time had come when thought must be given to the permanent housing of the collection. The building fund having increased to an amount to warrant such action, purchase of the site at the northwest corner of Michigan Avenue and Randolph Street was made in May, 1912. Construction of the Library's new and permanent home began in 1919 and the building was dedicated a little over a year and a half later in 1921.

Probably few people passing by 86 East Randolph ever notice the inscription "The John Crerar Library" deeply engraved in large letters in the stone over the wide entrance, or see the bronze tablet at the side informing them of the nature of the institution.

Inside the entrance one finds a beautifully executed foyer with marble floor, stone walls with simple and restrained ornamental carving, and over all a beamed ceiling beautifully colored in dull blue with conventional designs in gold.

At the left are three vaulted arches screened by wrought-iron grilles, fine in design and workmanship, like the entrance gates to a chapel. Behind these are the elevators, plain and utilitarian but dignified in design. Today, the first three floors of the building are given over to stores and offices, this corner of the "loop" being an ideal spot from the merchant's point of view. Eight levels or "floors" of stacks are housed on the fourth to the ninth floors of the building, where sixteen miles of shelving hold the major part of the 650,000 volumes and tens of thousands of pamphlets.

Stepping from the elevator out on to the tenth floor, (where you may go only if you have permission), you will see the "wheels going 'round." Here are the Accessions, Order, Continuations, Cataloguing and Classification Departments, arranged in this "flow-sheet" order around the one big room which takes up the entire floor. (Efficiency has to be considered in a library as well as in an automobile factory.) In the middle is the nerve center of the Library, the huge official catalog and the shelf-list with its telautograph communication with the fourteenth-floor delivery desk. It is through the routine of all these departments that each book must pass before it is ready for the patron in the reading room. This is, in effect, the clinic where neither the book nor its author can boast any secrets after the trained technicians have finished their job of tracing down the remotest of bibliographical and biographical data. This is an important, meticulous, slow, and expensive process. It has been estimated that each entry carried through routine costs the Library about $2.00, which is a considerable amount to be added to the original purchase price of an item.

The man who bears the brunt of all responsibilities smiles from behind his big, glass-topped, mahogany desk as

we enter his private office on the eleventh floor. Out the large, draped windows to the south we look down upon the Chicago Public Library, Grant Park, the Art Institute, Field Museum; out the east window we meet the ever changing beauty of Lake Michigan. On the walls behind us, to the right of us, to the left of us, on tables, on his desk, are books—small, large, old, new—books of every description. In this room is housed one of the finest collections of Americana, personally owned and collected by this eminent scholar himself throughout his many years as one of our outstanding bibliophiles.

Never too busy for a friendly smile, a pleasant word, he sits back in his big chair, strikes a match, slowly strokes the drooping ends of his mustache with the bit of his pipe as he holds the match to the tobacco and, before we know it, we are in the midst of a story, told as no one else can tell it, of this book, of that author, or of that collection; never fiction, always true stories, always with the human interest as the chief element. His more than thirty-five years of association with the Library have given Dr. J. Christian Bay a background, an acquaintance, and a respect in the professional world to be envied by all.

Besides the private office of the Librarian, the other offices, the Directors' Room, where the Board meets quarterly, and a suite rented to the Research Librarian of the Western Electric Company, are located on the eleventh floor. Here, too, is the kitchen and lunch room, equipped with a gas stove, refrigerator, sink, electric grill, dishes, and tables to seat twenty people, where anyone on the staff may prepare his lunch.

On the north side of the twelfth floor is the Medical Department with its own catalog and its reading room shelves filled with the important reference tools, indexes, and outstanding source books in the medical sciences. Here we find the recently compiled Union Medical Catalog containing cards for books in all of the important medical libraries in the Chicago area, including Northwestern University Medical and Dental, University of Illinois Medical and Dental, University of Chicago, Rush Medical College, and Loyola University. By use of this catalog it may be ascertained what library has a given book. Because of the John Crerar's own excellent medical collection and also because of its centralized location, it was decided by the sponsors, the Institute of Medicine, to have this catalog remain here.

In this department, too, are kept all of the current numbers of the medical periodicals. A medical reference librarian is always on hand to give individual aid in the use of the catalog and the numerous bibliographic tools. The readers here, as might be expected, are for the most part doctors and students of medicine.

The Periodical Department, with its own staff, occupies the south side of the twelfth floor and here more than 3500 magazines in the special fields covered by the Library are currently received, recorded, and placed on the shelves where the readers may consult them without any formality. Considerable correspondence is necessary in this department, claiming overdue issues, and keeping the files up to date. (In addition to these regular periodicals the Library receives about 10,000 "continuations" which include annual reports, yearbooks, irregularly issued bulletins, etc., which are recorded on the tenth floor in the Continuations Department.)

Free checking service for coats and parcels is maintained on the thirteenth floor, where Library regulations prescribe that all brief cases, bags, and umbrellas must be checked.

The General Reference Department and reading room on the fourteenth floor, with its vaulted ceiling and tall, wide windows is used chiefly by research workers in all fields,—students, writers, and business men. A selected collection of about 8,000 volumes, intended to include the chief reference tools in the fields covered by the Library, are on the shelves in this room, quickly available for immediate use by the reader as well as the reference librarians who make extensive daily use of the numerous special handbooks, technical dictionaries, encyclopedias, and indexes.

Two of the most useful tools for the engineers are the Engineering Index, which indexes articles in more than 2,000 engineering and technical periodicals, and Chemical Abstracts, which covers in a similar manner practically all of the chemical periodicals.

The huge Union Catalog, sometimes referred to as the "Dep Cat," occupies the entire wall space on the fifteenth floor and contains over 2,000,000 cards from large public and university libraries scattered across the United States, including a depository collection of Library of Congress cards. Each of these contributing libraries has such a union catalog made up of the cards from the others. Thus, by learning from this catalog that one of the other libraries has a book not in its own collection, any library can supplement its collection through the system of inter-library loan, photostat, or micro-film service. This is of the greatest value to research workers who might otherwise be deprived of material pertinent to their work.

The John Crerar tends to be more of a collection of "live" and practical material, the type of books Bacon suggested were to be "chewed and digested." But, as might be supposed, it is not always our most recent books that we value as having the greatest potential. For this reason we are proud of those books in our stacks which furnish us with unusual historical source material in the field of industrial paper making, the knowledge and art of dyes and dyeing, and the collection on aviation which includes the library of Octave Chanute, famous pioneer in aeronautics and father of the biplane. Especially strong are the historical classics in mechanics and railroad engineering. It would be interesting, but impractical here, to list individually some of the rare and outstanding works; it would be difficult to know when to end such a list.

Answering questions is, of course, the principal function of this, as of all American libraries. The university professor, the engineer, the special investigator, the factory worker, the college student, and the casual visitor, have equal claims on our service. And questions we do handle, by the hundreds, by letter, by telephone, and "over-the-counter." Primarily, we are a reference library, but in 1940 we loaned 2,677 volumes on 2,362 requests from 389 institutions. We do not invite inquiries in fields foreign to our scope, and actually turn down requests of a trivial nature, such as puzzle and contest questions, as we feel that our time and efforts will be well enough occupied if we deal with none but the serious matters.

Those persons coming to the Library for the first time are usually quite surprised with the fast service with which their books are brought up from the stacks, and usually, too, are intrigued by the automatic book-lift. This machine, after being dialed like an ordinary telephone, automatically picks up a book from any floor and delivers it to the desired station on any other floor. In addition to this conveyor, which has twenty-two baskets on a continuously moving chain, there are two large-capacity lifts for books too large to ride on the conveyor. With this equipment the average length of time on a call (from the time the reader hands his slip in at the desk until the book is in his hand) is 3.4 minutes.

To handle the 10,000 yearly accessions, to execute the multitudinous

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THE DEFENSE TRAINING PROGRAM: A PROGRESS REPORT

Twenty-six courses, one hundred and twenty-four sections, thirty two hundred students—these brief statistics report the current status of the Engineering Defense Training Program.

The beginning of this Program was described in the March issue of the Armour Engineer. Authorized by the U. S. Office of Education and financed by the Federal Government, the courses were started for the purpose of relieving the shortage of engineers which now confronts the nation. Short-time, intensive instruction, in specific subjects which apply directly to defense industry, is the method which the Defense Training Program has adopted as an answer to this demand for technically trained men.

The first Program began early in January; the response to it showed that there was a tremendous demand for training of this nature. Consequently, after the Institute's regular second-semester night-school began, the second Program was organized. Eleven of the most useful courses from the first Program were retained, and, after a study of the evident needs, ten new courses were proposed. The approval of the U. S. Office of Education was obtained, and, with the assistance of Alexander Schreiber, A.I.T. '37, a campaign was begun to inform the city of Chicago of the new Program. Letters and posters were sent to every manufacturing establishment in the city, and to schools and libraries as well. A bulletin was prepared which listed the courses, and gave the prerequisites and specifications for each. This bulletin, with an explanatory letter, was sent to all members of the professional engineering societies in Chicago. The response was immediate and great. Applications poured in by the thousand, and a special staff of interviewers was recruited from the senior members of Pi Tau Sigma, honorary Mechanical Engineering fraternity. The applicants for the second Program were better qualified than those for the first, probably because the prerequisites for each course were set forth specifically in the bulletin. Only one out of each five who applied for the first Program proved to be qualified, while almost one half of those who sought places in the second were classified as eligible. Thanks to the very effective publicity, the Program attracted a large number of college graduates, with a respectable number of Masters and Doctors of various sciences. Some of the latter were immediately drafted into service as instructors.

Class schedules were arranged by Dean Rogers, the director of the Defense Training Program, who took over every room on both the Lewis and the Armour campuses which was not otherwise occupied. None of the regular evening classes was disturbed, but it cannot be said that any great length of time elapsed between the departure of the regular evening students from their classrooms and the entrance of the Defense men! Incidentally, the enrollment in the regular evening school, in the college credit courses, was not adversely affected. The Defense Program has apparently brought into the night school an entirely new group. It is to be hoped that these men will continue in their program of self-development after the Defense Training Program has been discontinued.

The teaching staff in the new Program is again composed of men taken from industry. Armour alumni are prominently represented, as they were in the first group of courses. The designation of certain instructors to act as "vice-presidents" in charge of their particular courses has proven very satisfactory, and has contributed very largely to the success of the Program. Particular recognition should be given to Paul A. Carlstone, A.I.T. '33, M.E., for his work in the Elementary Machine Design course. Among his instructors in the second Program are O. Klima, A.I.T. '34, M.E., and A. Keating, A.I.T., '26, M.E. A. H. Brown, A.I.T., '15, E.E., set up six new sections in Production Planning, a course which has been in great demand. In spite of, or perhaps because of, the fact that the work in this course has been rigorous and demanding, with frequent quizzes and time-consuming homework, interest has been maintained at a high peak.

The proof of success in these Defense Courses is continued attendance, since the student invests only his time, and takes away knowledge rather than academic credit. The first derivative of attendance with respect to time, to express the matter mathematically, is the criterion by which the excellence of the course and the instruction can be judged. If the slope of the attendance curve is zero, or slightly negative, the situation is favorable or normal. If the slope is large and negative, a revision of the course is necessary. If the slope is positive, the instructor is exceptionally good and his material is well organized. Experience with the first Program indicates that the more difficult the course, the better will be the response.

A course which was set up in answer to a very definite demand was Inspection and Quality Control. Some difficulty was experienced in finding instructors for this subject, and the assistance of R. M. Van Valkenburgh, University of Cincinnati, Coop, '36, was enlisted. A staff of instructors was obtained, and, working together, they laid out courses on elementary, intermediate, and advanced levels. Seven sections are now in progress, one being given especially for employees of a large company which finds itself making milling machines and gun mounts instead of more peaceful merchandise.

Time and Motion Study is again in demand, and six sections are in progress, under the vice-presidency of Mr. Van Valkenburgh. Tool Design is being given in six sections, under the general supervision of Professor J. C. Kozacka. Four sections of Metallography are being given, again under Professor Carpenter's guidance.

The announcement of the course in Plastics brought more than two hundred qualified applicants, every one of whom possesses at least one college degree. Three sections were organized, with three instructors who will rotate among the sections. Thus each section will cover the whole field, although the order will vary. Samples of hundreds of new plastics have been supplied by leading manufacturers, in forms ranging from colored discs to

suspenders and a pair of dice (confiscated by the chairman of the Defense Training Committee). The great interest in Plastics can be traced in part to the fact that die-casting metals are becoming difficult to obtain because of priorities.

Explosives is another course which has drawn a large enrollment of highly qualified men. The first section, with more than sixty students, is in progress, with Mr. Edwin I. Cotter, chief chemist of the Goldsmith Brothers Refining and Smelting Co., as instructor. Mr. Cotter, a graduate in chemistry from the University of Illinois, took the course in explosives given at the Federal Explosives School at Penns Grove, N. J., during World War I, and was cited for his work in explosives. Dr. Vasily Komarewsky of the Chemistry Department has attended a special course for explosives' instructors at Washington University, St. Louis, and will be prepared to give a later course in this field.

A course which is unique in its content and instruction methods is Advanced Testing Methods, which is being supervised by Dr. L. W. Wallace, Director of Research of the Crane Co. This course consists of thirty lectures on all phases of modern materials testing, the speakers on each subject being the best qualified individuals in the Chicago area. The lectures are being given on Tuesday and Friday evenings, in the auditorium at Lewis; a smaller class room was quickly outgrown, and all comers can now be accommodated.

Additional sections of the courses listed in the second Program are still being organized in some cases. No further extensive evening programs are contemplated for the immediate future, although many of the courses in the first Program will be continued in advanced form through the summer. The adverse effects of good weather upon attendance in evening school indicates that an elaborate summer evening program would be likely to encounter an adverse attendance-time derivative.

The "accelerated" program, by which the regular engineering curriculum would be speeded up, with continuous operation during the summer, has been abandoned, because of the vigorous protests of most of the engineering schools. Instead, many colleges, with Illinois Institute among them, are planning to offer full-time Defense Training Programs. Plans are now being formulated for courses to train technicians for certain specific defense needs, in connection with the aircraft-engine plants which are now under construction in Chicago. In addition, courses are projected by which technical high-school and junior-college graduates can be given intensive training in the fundamentals of mechanical engineering. Details on this, the third Engineering Defense Training Program, will be announced as soon as plans have been worked out by the Defense Training Committee.

J. I. Yellott.

OBITUARY

CHARLES BEACH NOLTE

Charles Beach Nolte, a member of the Board of Trustees of Illinois Institute of Technology, died April 29, 1941.

Mr. Nolte was president and director of Crane Company, Chicago, since 1935; he had the same posts with Crane subsidiaries, including Crane Company of Mexico; Crane, Ltd., Montreal; Crane Export Corporation; Crane Enamelware Company; Canadian Potteries, Ltd.; and Warden-King, Ltd. He was also a director of Trenton Potteries Company.

Mr. Nolte was born in Mattoon, Illinois, in 1885. He graduated from the engineering school of the University of Illinois, and subsequently worked as mechanical engineer at the University's Engineering Experiment Station. He joined the Robert W. Hunt Company in 1909, and was successively engineer, manager, vice-president and general manager, and president, general manager, and member of the board of directors.

He was a member of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, Western Society of Engineers, and the Newcomen Society; and of the Chicago Engineers Club, Chicago Club, Union League Club, University Club, and South Shore Country Club.

Funeral services were held May 1 at Bryn Mawr Community Church; burial was at Oak Woods.

GEORGE LAWRENCE SCHERGER

Doctor George Lawrence Scherger, for thirty-four years a member of the Armour faculty, died March thirty-first, after an illness of several months. He was sixty-six years old.

Doctor Scherger was born in Lawrenceburg, Indiana. He took his bachelor's degree at Indiana University, and did graduate work at the University of Leipzig, the University of Berlin, and Cornell University, where he received his Ph.D. degree. In 1899 he joined the faculty at Armour, and there he conducted classes in history until 1933. Beginning in 1929 he was assistant pastor, and later pastor, of St. Paul's Evangelical Lutheran Church, and continued his pastoral duties until his last illness.

Doctor Scherger was an earnest student and prolific writer on history and political science. His fluent and interesting lectures on history will be remembered by thousands of Armour students.

Funeral services were held at St. Paul's Church, April third, and were attended by a gathering of friends which taxed the capacity of the building. The honorary pallbearers included Governor Green, Mayor Kelly, United States Senator Brooks, Clayton F. Smith, president of the county board; Karl Eitel, Carter H. Harrison, collector of internal revenue; W. A. Wieboldt, Oscar F. Meyer, and Doctor Herman N. Bundesen. The officiating clergyman was Doctor Louis A. Goebel, president of the Evangelical Lutheran Synod of America.

FIVE YEARS WITH THE CO-OPS

By

L. J. Lease

The Co-operative Course in Mechanical Engineering, which started some five years ago, found itself January 29, 1941, when fifty-seven men were graduated. This was the largest graduating class in the history of the Mechanical Engineering Department of the Armour College of Engineering. Many industries found themselves in possession of valuable talent at a time when it was much needed. Young men, more valuable to them than others that could be secured from outside sources at any price, were in positions of responsibility which were unusual for men just finishing their college course.

One graduate took over the editorship of a company publication with a circulation of forty-five thousand; two others, the supervision of from fifty to a hundred workers in a rapidly growing defense project. One student yet to graduate was made production manager of a division of his company at the end of his junior year. The history of graduates and their positions, only two months after graduation, would make an interesting story.

Success of any project is usually closely associated with the intelligent cooperation of the people responsible for carrying it forward.

TABLE I

Type of Shop	*Equipment Used*	*Operations Performed*	*Length of Time in Weeks*	*Fundamentals to Be Mastered*
Milling	Plain milling machine Universal milling machine Hand mill Automatic mill Hobbing mill Pantograph or Engraving machine	Forming, straddling, hobbing, slotting, slabbing, facing, sawing, vertical milling, and milling. Grubbing, narrow grooving and engraving.	16	Working knowledge of fixtures and gauges. Effect of material upon machineability. Effect of various coolants. Elements affecting accuracy. Removal of metal at high speed with accuracy. Reasons for various types of machines.
Heat Treating	Large oven-type general utility furnaces Small oven-type general utility furnaces Controlled atmosphere furnaces Tempering furnaces Forge furnaces Rotary general-utility furnaces Salt bath furnaces Lead pot furnaces (All with phyrometer control or indication)	Annealing Hardening Tempering Carburizing Nitriding Cyaniding Spheroidizing Coloring	8	Understanding of the principles of heat treatment of plain and alloyed steels. Knowledge of treatment for cast irons. Understanding of causes for change in shape. Reason for selection of specific type of furnace.

The industries which have had the greatest success with this co-operative program are the industries which have put more than a pay envelope into it. Many industries have a highly developed plan of procedure for their pairs of students from the time they start as freshmen to graduation. Some also have a pay schedule, either weekly or hourly, which carries definite periodic increases in pay over the five years. The hours of work may be shortened during depression but the rates usually are carried through. Some shop plans require study of machines and processes on which the student must report, sometimes in class, sometimes in writing. Such a program requires an instructor or supervisor with whom the students must work or to whom the students must present the written reports. Students in such industries have a feeling of belonging; they are usually boosters and have continued to work for the companies with which they spent their college days.

Most industries have much that may be learned in addition to the immediate job and how to perform it correctly. Several industries use a plan like that shown in Table I, in which the student must learn things about production tools and make reports. Under such a plan the students get the maximum education. They not only learn what the college has to offer but learn the maximum from their contacts in the factories.

A very simple plan is shown in Table II, which also shows the pay increases. The works manager for the company using this plan made it his business to see the students once or twice each two months and discuss their problems. He has not lost any graduates to another company. The students may not follow these plans in the order in which they are set up, on account of varying conditions in the plants, but over the five years all the items would be covered.

One company, in which the students work on processes rather than tools, requires a complete report on the processes involved and what the students have learned. These reports are long and detailed and the assistant chief engineer goes over the reports with the students just before they return to college, correcting any mistakes in thinking or writing. These students are proud of their jobs and talk of the interest their company takes in them.

The great majority of the students work on production in factories where they have ample opportunity to learn processes, the handling of machines, and the handling of people. Such experience leads naturally toward production types of jobs and many indus-

(Turn to page 53)

Why, it's "33 to 1"... even a 'BLIND MAN' could tell the difference!

Try a glass—and you'll agree that BLENDING 33 FINE BREWS SURE MAKES PABST BLUE RIBBON A MORE DELICIOUS BEER... and a dependable pal whose goodness never varies!

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BETTER MOUSETRAPS

Because so many natural phenomena are affected by the temperatures at which they occur, the laboratories of the Armour Research Foundation demand no less than fifteen constant-temperature chambers of various types. These range from small electrically controlled ovens to full-sized rooms, and this number does not include the many special chambers which are erected from time to time for particular purposes.

One of the most interesting of these chambers is the large constant-temperature room built into the second floor of the main Research Foundation building and serving the needs of the Experimental Engineering Division in large-scale thermal studies. This room is of the general size and shape of a two car garage, with 270 square feet of floor area and an inside height of ten feet. Lined with cement and fitted with a floor drain, the room is surrounded by a four-inch cork insulation. The big thick double doors are of the type used on cold-storage rooms. Over the inside walls, floor and ceiling are thermocouples, seventy in all. These are gathered into thick master cables and led through the walls to an adjoining room housing the temperature-measuring apparatus.

The room has interior connections for steam, water and electric power. Suspended from its ceiling are two large refrigerating coils backed by air-circulating fans. The refrigeration machinery is located in the basement of the building, but controlled from the master panel just outside the chamber itself.

This spacious constant-temperature room might better be called an "artificial weather" chamber. It is capable of reproducing anything from glaring sunshine or a tropical downpour to a bitter cold antarctic winter night.

The uses of such a room are many. Not long ago a small house, designed with modern insulation, was erected within it. The weather conditions were adjusted to the desired point, and a powerful artificial sun was aimed at the only window in the house. Circulating water removed heat from the interior and conducted it outside for measurement. For days the sun beat down mercilessly on the little house while instruments were read and notebooks were filled with figures. When it was all over the staff knew just how much of the sun's heat could be kept out by drawing down the window shades.

Sometimes the room is full of new household refrigerators laden with butter, eggs, meat, milk, vegetables, and other good things, but woe unto the researcher who succumbs to temptation and disturbs the thermocouple in the fresh strawberries or salami, or who dares to touch the master controls which can "shift" the refrigerators from Tucson, Arizona, to Fargo, North Dakota. On other occasions there may be a heating stove in the center of the floor, burning merrily while a multitude of thermocouples in a surrounding circular shield measure the amount of heat radiated in various directions.

Some months ago the Research Foundation cooperated in studies of stratosphere parachute-jumping. When a man leaps out of an airplane at 35,000 feet he encounters Antarctic temperatures and a wind of perhaps 200 miles per hour. Unprotected under these conditions he will freeze to death in a matter of minutes. Hence great care is needed in the design of his clothing and face protection. To test these articles without risking lives the big constant temperature

(Turn to page 53)

Room Simulating Extreme Conditions in Stratosphere Jumping.

ILLINOIS TECH RELAY GAMES

By

ALEXANDER SCHREIBER

Five hundred strong, from all over the middle west, they came to Chicago last March for the renewal of Chicago's oldest track and field classic—THE ILLINOIS TECH RELAY GAMES. . . . They came and set new records in the renewal of a classic indoor carnival that Chicago is proud to call its own. A few left with medals and cups. One suffered a multiple fracture of the ankle. Another was defeated for the first time in his life. All will remember the meet.

Since the merger of Armour Institute of Technology and Lewis Institute last summer to form the largest engineering school in the United States, the well-known name of former years, THE ARMOUR TECH RELAYS, has been changed. No loss of prestige, or drop in attendance was expected, and none occurred. Evidence of contestant interest is shown by the large registration. It is evident that the excitement and the prestige of the Relays will continue to be a factor in building favorable publicity for the larger Institute.

With press time for the May issue of the ARMOUR ENGINEER AND ALUMNUS drawing close, it may seem anticlimax to write about an event already recorded in the papers. A review of statistics and of entrants should, however, emphasize the importance of the meet and bring to the attention of alumni and friends one of the most outstanding pieces of work done by the Institute in the athletic field.

Under the direction of John J. Schommer, the committee in charge of the Games provided a thriller. Coach Norman Root, track coach of Tech thinclads, provided the best of track management. Spectators, three thousand of them, never once felt impatience or annoyance because of lagging events.

A glance at the statistics prepared in a twenty-eight-page brochure for distribution to all teams entered reveals some striking facts. Forty-three colleges and universities registered some 500 contestants. Actually, 313 athletes made the trip to Chicago for the Games March 15, 1941. There were 167 individual events in the college section and 93 individual events in the university section, not counting the relays. One finds that 313 men competed in 472 individual events, making 1.5 events per competitor entered. . . . That is a pretty stiff schedule for any group of athletes.

Enough of statistics . . . it's time to touch upon the high spots of the meet. Three records were established. A youngster from Drake University fractured his ankle, as already noted. A cowboy from Nebraska proved beyond a doubt that he was the best dashman of the year.

Starting from the tail end of the summary, let's look upon the accomplishments of Nebraska's little Gene Littler. Our acquaintanceship with the little mite goes back to the Games of 1940 when he loomed as the dark horse of the meet, with no previous record in the Chicago area, but the proud possessor of a large number of press clippings from the west. He romped home last year to tie records in the dash and win the quarter mile. Gene is redheaded and wears cowboy boots which, to our way of thinking, must unduly punish his pair of million-dollar feet, but he still seems to have but little trouble in winning the sprints. Commenting a bit further on his individual characteristics—according to some, he has been dubbed "Red" because of the flamboyant shade of his hair—according to our version, promulgated by Jack Morris of this department, he is known as "Red" because that is the shade of his opponents' faces after he finishes way out in front in the dash events. That is what he did during the thirteenth running of the Games. First of all, Gene won the 70-yard dash in the college division, but not in record-breaking time, although he is co-record holder for this event. Later in the evening he broke the record in the quarter-mile run and finished pulled-up, way ahead of the field, with a 49.3-second time tucked away. This time broke the record for this event established by Orville Wagner in 1939.

The hardluck, broken-ankle boy of the meet was Hal Nugent, Chicagoan, who attends Drake University. Rated as one of the best pole vaulters entered in university competition, he dropped from 12 feet in an awkward position during his first try in the vault and was removed to Mercy hospital where Dr. J. F. McNamara ministered to him.

Michigan Normal again walked away with the college-division championship by an overwhelming point total of 57. Northern Illinois State Teachers of De Kalb took second place with 33 points, and Coe College was a close third with 32 points.

In the university division Wisconsin trampled roughshod over Illinois and Marquette to win with a point total of 44¼, while Nebraska, mainly on the merits of Littler, piled up 23 points for sixth place.

The surprise of the evening came in the defeat of Bill Williams of Wisconsin, who the week before won the Big Ten Conference pole-vault championship with a try higher than the existing Tech record. The win was shared by Edward Thistlethwaite, son of the famous Glenn, and Bob Kincheloe of Chicago. We might add that Thistlethwaite is current Tech record holder for this event, by virtue of a 13 foot, 11⅛-inch try in 1939, a height he has not reached in competition since, and that Bob Kincheloe never before had even approached the height of 13 feet, 3 inches which was the winners' height in 1941.

To get back to the record breakers, let's look at the hurdle events, where there seems to be something doing each year. First of all, the committee in charge changed policy with respect to the low-hurdle events and, instead of the usual three flight affair, six hurdles were used in order to bring the meet's hurdle events into the same category with that of other meets. Here is where the vaunted Charlie Horvath of Northwestern and Big Ten fame was taken into camp by a newcomer, Robert Kahler of Nebraska. He travelled the distance in 7.9 seconds to establish a new record for this event.

In the low hurdles, however, Northwestern's Horvath lived up to his reputation as topflight hurdler of the Chicago area. In winning this event in the time of 8.9 seconds he triumphed over a teammate, Joe Finch, former Tech Relays defending champion in this event.

Tilden Tech of Chicago took away championship honors from Austin in the high-school relay by travelling the distance of one-half mile in 1 minute, 35.4 seconds.

Winston Rogers of Lincoln University, college-division entrant, topped the high-jump bar at 6 feet 3 inches, to outjump anything that the university division had to offer.

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Great depth is being attained with electric rigs using Westinghouse equipment. To date, holes have been drilled as deep as:

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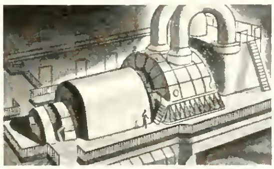

STEAM-TURBINE GENERATOR

Installed in Philadelphia is the largest single-shaft steam-turbine generator ever constructed. It was built by Westinghouse and can develop:

1. 17,500 kw
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3. 165,000 kw
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The Seadrome Contact Light, developed by Westinghouse to facilitate night landing of seaplanes, is turned on and off by:

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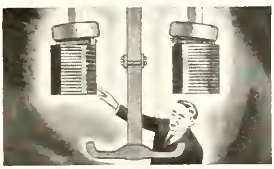

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Let's Try It Again!

Regardless of how you came out on the last series of questions, here's another chance for you to see how familiar you are with important developments in the field of electrical engineering.

Optional answers are provided for each of the six questions listed at the left. Your task is to check the correct answer in each instance. To eliminate any peeking, the answers are printed below, upside down.

If you get four out of six correct you'll be doing all right. Five out of six passes you with honors. If you should know all the answers you can give yourself a good pat on the back.

★ ANSWERS ★

The Oscillograph — Ans. 4.
Lightning Arresters — Ans. 4.
Deep Oil Well Drilling — Ans. 3.
Steam-Turbine Generator — Ans. 3.
Seadrome Contact Light — Ans. 3.
De-ion Principle — Ans. 1.

Westinghouse *"The name that means everything in electricity"*

THE BOOK SHELF

Paradise Lost, by Grant McColley. Chicago: Packard and Company. 1940. xi + 362 pages.

The romantic school of literary criticism, which regards poetry as inspiration, is inclined to treat the investigation of source material with contempt, or even with denunciation. Such critics do not seem to realize that a poet must have material with which to work. Fortunately, their influence seems to be on the wane: for instance, nobody seems to mind acknowledging that Shakespeare wrote plays to make money, and used as source material whatever looked like substantial capital.

Somehow or other, critics are often not able to contemplate Milton as they do Shakespeare. Some, like George W. Whiting, will go so far as to call it heresy when an investigator begins to show where Milton got his ideas. What Mr. Whiting and his brethren think of an investigator who shows not only where Milton got his ideas, but also where he got his vocabulary to express them, will be interesting to hear. In his study *Paradise Lost,* Grant McColley has contributed largely to just this information.

It was shown at the end of the last century and suspected long before that Milton drew his inspiration from books. Not only his philosophical ideas, but his very descriptions of nature are literary. But it has not been generally recognized that Milton used the vocabularies of his sources to a great extent.

Mr. McColley shows a careful literary artist constructing his epic out of his reading. How closely Milton's poetry parallels the source material could not be guessed: it must be demonstrated. Mr. McColley demonstrates thoroughly and satisfactorily that Milton used the ideas and even the vocabulary of other writers to construct his epic, and even to construct minor incidents and scenes. Nowhere is it better shown than in the discussion of the dialogue on astronomy, which is Chapter IX of Mr. McColley's book.

It is very easy to make such a study as this—a study of source material and vocabulary—depressingly pedantic. It can be made so tedious that only the resolute specialist will pay any attention to it. On the other hand, it can be discussed in uncritical and haphazard fashion so that no scholar can take stock in it. Mr. McColley very ably avoids both dangers. His book is thorough and convincing in showing Milton's use of source material, but it is neither pedantic nor tedious and can therefore be recommended to the general student of English literature.

In the second part of *Paradise Lost,* Mr. McColley reaches certain conclusions about the date of composition of Milton's poem and of various parts of it. In general, his discussion seems quite sound, although one may wonder whether Book IX, which continues the story of Book IV, was not written earlier than Book V. Stylistically it is closer to the Minor Poems, and furthermore it omits any mention of Eve's dream in Book V, which one would naturally suppose must be included in the account of the final temptation.

Mr. McColley's interpretation of Milton's thought, although it is only a side issue in this work, is more conventional than perhaps one might expect. It will be interesting to see whether, when Mr. McColley has completed a like study of *Paradise Regained* and *Samson Agonistes,* he will not feel inclined to modify his views of Milton's closeness to orthodoxy. The temptation in *Paradise Lost* shows the triumph of irrational passion; the salvation in *Paradise Regained* is the salvation of passionless rationality. One may well wonder whether Milton's final answer in *Samson* is not the result of dissatisfaction with both passion and reason in themselves.

These objections are noted simply to suggest that there is much room for further work along the lines shown by Mr. McColley; they are not at all a reflection on the present work. That is, and will probably remain, a contribution to Miltonic scholarship that must be reckoned with. Certainly Mr. McColley has rendered futile the objections of those who do not want to think that Milton was so literally a literary poet, and who do not want to think that, like any first-rate craftsman, he used every bit of his material with shrewd calculation of its effect. Once the idea of the good, blind, old man getting his inspiration directly from Above and dictating it to attitudinizing daughters is finally out of the way, further investigation should be quite fruitful. And future investigators can hardly avoid following Mr. McColley's lead.

S. A. Nock

Industrial Health, Asset or Liability, by C. O. Sappington. Industrial Commentaries, Chicago.

Statistics indicate that illnesses probably cause fifteen times as much interruption of work as do industrial injuries. The average man loses seven and one-half days of working time a year; the average woman, over ten days. Dr. Sappington's book is a plea for more serious attention to this drain on the national productive power, and he outlines quite simply and clearly the organization and program required. One chapter deals with health services for the small plant, giving costs and details of the arrangements by which in several cases groups of plants have availed themselves collectively of the part-time services of a physician and nurse. He recommends as the principal activities in an industrial health program the examination of all incoming employees to safeguard the employee's own health, to protect other employees from possible contagion and as insurance against improper claims for compensation for occupational hazards. After the employee is hired, there should be periodic health examinations and the advice of a physician or nurse should be available whenever needed. In some firms it is found advisable also to furnish dental and optometric services.

In addition to overseeing the usual dispensary and first aid services, the plant physician should make a systematic study for the prevention of disease and injury, investigating and ameliorating special occupational hazards, guarding the plant against contagions and epidemics and cooperating with health authorities in the community.

Dr. Sappington emphasizes the importance of the part played in health by mental conditions and recommends for the larger plant the services of a psychiatrist, and that in any plant the physician be one informed as to mental hygiene and sympathetic and

understanding in analyzing the problems of the employee. Failure on the job is all too often the result of anxiety over money matters or failure in the outside life of the employee; a tactful and experienced physician is required to aid the employee in these matters without appearing to intrude on his privacy.

Specifications for the ideal industrial physician are given.

As a whole, the book is intended for the lay reader and is a plea for the adoption of systematic programs. At the same time, there are in it several chapters of interest to all laymen, such as the rules for physical health and mental hygiene and for the avoidance of improper fatigue, scattered through the book. An appendix supplies a number of useful forms for diagnosis and record. The book is made more readable by the free use of summaries and should be of much use to anyone responsible for a health program in industry.

H. P. Dutton.

Medicolegal Phases of Occupational Diseases, by C. O. Sappington. Industrial Health Book Company, 1939.

Occupational diseases are among the penalties exacted by our industrial system. Primarily of concern to a portion of the employees in some industries, in their broad aspect they are a challenge to the community as a whole, and a waste of human resources. Nothing can be accomplished by attacking the problem with no preparation other than emotional desire to prevent distress. The magnitude and the importance of the matter are such as to need intelligent effort on the part of the worker, the employer, the medical and legal professions, insurance organizations, and public authorities. The ideal to be approached is, of course, complete prevention. The day-by-day procedure should be to reduce the incidence of industrial diseases, to do all that is possible to care adequately for the sufferers, and to provide relief for the financial burdens due to the cost of illness and the loss of earning power.

The medico-legal phases of occupational diseases are closely related to all the other phases. Moreover, in themselves they are intricate and important. Doctor Sappington's book, of some four hundred pages, indicates how intricate and how important, and it shows impressive familiarity with hazards, techniques, protective measures, the statutes, and the decisions of the courts. It represents wide research and extensive experience. To an engineer it is satisfying in its logical arrangement, its convincing citation of authorities, and the large amount of pertinent information contained in numerous appendices. The usefulness of the book is increased by its good bibliography, its comprehensive subject index, an author index and an index of case decisions.

J. B. F.

NEW TRUSTEE

Alfred Kauffmann, President of Link-Belt Company, was elected to membership on the Board of Trustees April 14, 1941.

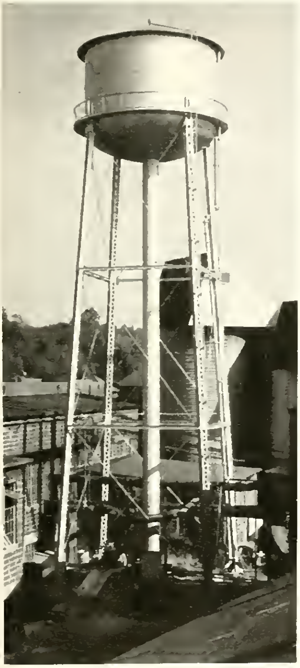
Mr. Kauffmann was born in Germany, and came to the United States at the age of three years. When sixteen years old, he worked as an apprentice for the General Electric Manufacturing Company; subsequently he was employed by Robert Hoe and Company, manufacturers of printing presses. His formal education in engineering was at Pratt Institute in Brooklyn, where he received the M.E. degree in 1901. After graduation he became a draftsman for Link Belt Company, and has been successively superintendent of construction, sales engineer, assistant to the president, manager of the Philadelphia plant, vice-president, and president.

Mr. Kauffmann's residence is in Chicago. He is a member of the Chicago, South Shore Country, Flossmoor Country, and Indianapolis Country Clubs.

ANNUAL ALUMNI BANQUET, TUESDAY, MAY 27, 1941
KNICKERBOCKER HOTEL

WILFRED SYKES ELECTED PRESIDENT OF INLAND STEEL

After this number of THE ENGINEER AND ALUMNUS had gone to press, announcement was made that Mr. Wilfred Sykes, chairman of the policy committee of the Institute's Board of Trustees, had been elected president of Inland Steel Company.



A DOUBLE-DUTY ELEVATED TANK

Here is an elevated water tank that lives a double life. Its total capacity is 60,000 gals. but one half of this amount is reserved at all times to operate an automatic sprinkler system that protects approximately 100,000 sq. ft. of floor area from fire.

The other 30,000 gals. of water is used for general water supply in this Eastern paper mill. Water is supplied from deep wells by electrically-driven centrifugal pumps, the tanks acting as a sort of surge chamber for the system. Water can also be taken from the public supply system when necessary.

This is a typical ellipsoidal-bottom tank with a cone roof and structural tower, fabricated and erected by the Chicago Bridge and Iron Company.

HELP! HELP! HELP!

Engineers of Armour, Lewis and Illinois Tech who have been drafted, or are about to be drafted, give heed. You may have failed to procure deferment; this may have been due to your neglect or your patriotism, or to the neglect or patriotism of your employer.

You engineers that have "jumped the gun" and enlisted in the air service or any branch of the United States service that does not involve your abilities or skill as engineers, pay attention.

The requests to this department for engineers are numerous. The army and the navy seek them and so does industry. The competition for June graduates and experienced engineers is lively. Starting salaries have been bid up and wages all along the line have been raised. For the June graduates there have been many attractive offers for men at \$150 to \$175 per month. The demand for engineers is greater than the supply.

Those who enter the governmental service are not available to industry. Many professors who teach in engineering colleges have left the teaching field to enter the service of the government or industry and so now a serious drain on the teaching staff of engineering colleges is felt.

Secretary of War Baker said that during the World War it took eighty-seven men back of the line to keep thirteen men at the front fighting and to take care of the civilian needs. Think of the equipment now needed by fighting men. It takes seven rifles per year for a soldier at the front. Big guns can be fired but a few hundred times before they must be rebored. Think of the guns, bat the ships, airplanes, ships, motorized equipment, clothing, food and countless other essentials necessary to wage war or prepare for it. Equipment wears out, is lost or destroyed. Think now also of the needs of civilians. They are now treated the same as combatants. They are blasted by long-range guns, airplanes and even must be protected from some within their own ranks. Gas masks, guns, fire-fighting equipment and many other essentials must be provided. The achievements of science that were used for the comfort, luxury and necessities of man now are turned against him for his destruction. Think of the enormous amount of construction that is necessary. Think of the enormous amount of production that is necessary. Think of the plans, the designing, the research, the testing, inspection, the inventive skill necessary for offensive and defensive methods. This all means engineers are necessary and essential.

I heard Mr. Sloan of General Motors say that during the early Roman wars it cost seventy-five cents to kill a man. In the World War the cost, he said, rose to \$25,000 to kill a man and he exclaimed that the cost in this war, if we actually go into it, and the gigantic scale of mechanized equipment planned is achieved, the cost to kill a man would be \$75,000. This means that the shift is steadily going from military manpower to more and more mechanization. It means that more and more engineers will be needed for designing, drafting, invention, testing and production.

To illustrate just how badly England right now needs engineers, Churchill two months ago said he would rather have 10,000 graduate engineers from American colleges than 1,000,000 American soldiers fully equipped. He needs them for research, designing, testing, invention and production. He needs them for technical offensive and defensive work.

Where are we going to get all the engineers the country needs? According to searches made and recently published there are approximately 12,000 engineers to be graduated this June in the United States and Canada, and we now are over 10,000 engineers short of what we need. It takes four years of successful high-school training in an accredited high school at which a student takes the proper courses, which include physics, mathematics, and chemistry. It then takes four more years of hard work at an accredited engineering college to produce a B. S. in engineering. Some students study a year to three years longer, taking a master's or doctor's degree. After this, several more years are spent in industry, in training courses, to prepare an engineer for his life's work. Yet you engineers, for patriotic reasons, join the army or navy for fighting and not for technical work. The draft boards, due to patriotic reasons or misunderstanding of your worth and the difficulty of your replacement, send you into the service to carry a gun. Many industrial organizations fail to realize the situation and from ignorance, fear of the Government and for a show of patriotism refuse to ask for deferment.

So now pay attention! I want all you engineers from Armour, Lewis and Illinois Tech, about to be drafted to ask for deferment. If you have

joined the army and navy as draftees or if you have voluntarily enlisted, write our Placement Office so that we may keep a record of where you are in service as a soldier. Then when the Government or industry needs technical men for technical or engineering service we shall know where you are. If we actually enter the war and start fighting, this available information will do much to save time and confusion when engineers are needed for technical service.

John J. Schommer,
Director of Placement.

Editor's Note

After we had sent this article to the printers, we received a press release from the Cook County Headquarters of the Selective Service System. It bears so directly on Professor Schommer's comments that we quote a portion of it, in the words of Paul G. Armstrong, State Director:

"For the defense of our country, an idle machine is no better than a regiment without arms. In procuring men for military training, it is important that we do not take men from either industry or civilian life who are needed in their present jobs for the national health, safety and interest. Industry must be particularly careful not to deplete the production machinery of the country. If a man has had special technical training—either in school or in the shop, if he is now in part-time training at a trade or technical school, he may be badly needed, either now or later, in the national production effort. Every employer is therefore patriotically bound to assist in securing deferment for men whose special skill or training is vital to industry until after the rearming program has been completed. I do hope that all employers will put aside the false idea that it is unpatriotic to request deserved deferment for a registrant in spite of his importance to industry."

THE FALL ENGINEERING CONFERENCE

Illinois Institute of Technology is developing plans for a conference to be held annually in October, on an engineering subject which may be varied from year to year. Power production, transmission, and consumption, which are discussed in the Midwest Power Conference, held annually in April, will not be included in the fall program.

The subject for 1941 is to be AIRPORTS, and the tentative dates are October 30 and 31. Besides such obvious problems as grading, surfacing, and drainage, it is expected that there will be discussion of building construction, administration, fire protection, lighting, communications, and transportation of passengers to and from the field. Information received from officers of airlines and from public officials indicates that the subject is of great current interest and that the conference should be of real value.

Comments or suggestions may be addressed to The Armour Engineer and Alumnus, for the attention of the conference director.

ANNUAL ALUMNI BANQUET, TUESDAY, MAY 27, 1941

KNICKERBOCKER HOTEL

FROM YEAR TO YEAR

A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

MAN OF THE MONTH

The first graduating class of Armour Institute contributes the candidate for the man of the month. In 1897 William Fargo Sims mounted the stage of Armour Mission and received his degree as a Bachelor of Science in the department of Electrical Engineering. From that moment this man has moved forward until today he stands at the very head of his profession.

Two strains appear throughout the career of Mr. Sims. One is his connection with naval and military affairs, and the other his continuous rise in the engineering profession. He was born in Green Bay, Wisconsin, on September 14, 1875. His primary education was received in Chicago public schools and early in the nineties he was graduated from the Chicago Manual Training School.

Entering Armour with the first class in 1893 he was graduated in 1897. Later, in 1903, he was awarded the professional degree, Electrical Engineer. He was married to Rosa Lillian Dunham in October, 1903.

Mr. Sims' military and naval record shows that he served in both the navy and in the army. He was a member of the Illinois Naval Reserve from 1894 to 1898. He took active

part in the Spanish American War, first as a non-commissioned officer in the Army and later as Second Lieutenant, Second U. S. Volunteer Engineers. After serving with the Army of Occupation in Cuba he returned to the United States and was identified again with the Illinois Naval Reserve during two periods, 1900-1904 and 1907-1916. He retired from this service with the rank of Lieutenant Commander and Chief Engineer. He held the rank of Major in the Illinois Reserve Militia from 1917 to 1920.

After graduation from Armour Mr. Sims was assistant engineer for the Chicago Telephone Company. He held a similar position with the Chicago Edison Company from 1901 to 1906 when he became engineer for the Board of Supervising Engineers studying the Chicago traction problem. In 1911 he entered the Stone and Webster Engineering Corporation as construction engineer. His first connection with the Commonwealth Edison Company came in 1916 when he served in the capacity of field engineer. He continued in this position until 1929 when he was made assistant engineer of the Inside Plant Division. He was made engineer of this division in 1930 and in 1932 became chief electrical engineer; this position he holds today.

Accompanying his steady rise in the engineering profession was his continuing interest in professional organizations. Accordingly he became identified with many groups which include the following: Fellow, The American Institute of Electrical Engineers; Member, The Western Society of Engineers; Director, Electric Association of Chicago; Director

Utilities Research Commission; Chairman, Committee on Electric Switching and Switchgear, Association of Edison Illuminating Companies; Member, National Committee of the International Electro-Technical Commission; Member, Electrical Standards Committee, American Standards Association.

Early in the century, when the Armour Alumni Association numbered only a few men Mr. Sims was one of the energetic spirits that kept things moving. He was president in 1901 and 1902. In 1938 he was elected to the Board of Managers to represent the class groups, 1897-1902.

Because of his great interest in Armour affairs and because many Armour graduates have worked with Mr. Sims during the past forty-five years, Armour men will be interested in knowing that his son, William Edward Sims, Purdue, '35, is following a similar career. He is now on active duty as an engineer officer on the destroyer, U. S. S. Crosby.

Mr. Sims is a member of the Union League Club of Chicago, the Naval and Military Order, Spanish-American War, and the United War Veterans. He is a charter member of the Armour chapter of Phi Kappa Sigma Fraternity. His residence is at 633 Thatcher Avenue, River Forest, Illinois.

APPRECIATION

In the past year much valuable assistance has been given to the Alumni Editor by Armour men and others not connected with the Institute. Contributions have been received from remote points on the globe, and this has made the Alumni section of the ENGINEER AND ALUMNUS a record of Armour men everywhere.

In recognition for their valuable assistance we express our thanks by listing some of the individuals who have made our work easier.

Perhaps the greatest assistance was rendered by Harry P. Richter, C. E., '32, who, although without title, acted in the capacity of Associate Alumni Editor. Others include: J. H. De Boo, M.E., '35; R. M. Krause, M.E., 31; President Henry T. Heald; C. J. Jens, F.P.E., '32; Professor J. B. Finnegan; J. J. Schommer, Ch.E., '12; Eugene Voita, Arch., '25; G. B. Perlstein, Ch.E., '16; R. M. Henderson, E.E., '02; B. J. Weldon, F.P.E., '30; C. W. Dunbar, F.P.E., '38; R. K. Freeman, F.P.E., '37; W. J. Tallafuss, Ch.E., '36.

Many others might be singled out for their help, and more especially the staff in the Alumni Office who were always at hand to supply the missing data. To all of these our thanks.

1904

WICKERSHAM, EDWARD J., M.E., is a Mechanical Engineer for the Fuel & Heat Engineering Co., 1451 Hood Ave., Chicago. His home is at 9429 Justine Street, Chicago.

1906

MCCRACKIN, WALLACE, E.E., of Hamilton, Montana, passed away on November 4, 1940.

WANNER, FRANKLIN, M.E., who is Real Estate Broker with Quinlan & Tyson, 1571 Sherman St., Evanston, has recently moved to 1533 Chase Ave., Chicago.

1907

NIND, JOHN NEWTON, M.E., is President of the Nind Realty Co., 200 Division Ave., Grand Rapids, Michigan. His residence is 532 Gladstone Ave., Grand Rapids.

TOMPKINS, GEORGE D., C.E., has retired from business and may be reached c/o R.F.D. No. 1, Montague, Michigan.

1908

DOUTHITT, MERTON J., C.E., is Utilities Officer at Fort Custer, Michigan. His temporary address is 32 Wiltshire Ave., Battle Creek, Michigan.

WOLTERS, GEORGE F., Arch., is connected with Wilbur Watson & Associates designing the Ravenna Ordnance Plant, Ravenna, Ohio. He resides in Hiram, Ohio.

1910

GODFREY, FRANK O., E.E., who is in the Engineering Dept., Illinois-Iowa Power Co., Decatur, Illinois, has recently moved to 164 N. Summit St., Decatur.

PASHLEY, ERVIN S., Arch., has recently moved to 831 S. W. Vista, Portland, Oregon.

1911

GOUGLER, JUDSON H., M.E., is Associate Mechanical Engineer for the U. S. Navy in the Marine Diesel Dept. of Fairbanks Morse & Co., Beloit, Wisconsin. He is living at 827 Central Ave., Beloit, Wisconsin.

JONES, HARVEY W., C.E., is the Washington Representative for T. C. Field & Co., 823 Colorado Bldg., Washington, D. C.

1912

ANDERSON, SEYMOUR CLARENCE, C.E., who is a Construction Engineer with the Standard Oil Co. of Kentucky, 742 Marietta St., Atlanta, Georgia, has changed his address to 3499 Roswell Rd., Atlanta.

ERICKSON, GEORGE C., E.E., conducts his own business as electro-chemical radium technician at 30 N. LaSalle Street, Chicago.

GEISLER, RUPERT J., C.E., is employed as Sales Engineer for A. H. Dobler & Associates, 548 Railway Exchange Bldg., Chicago. He is residing at the Illinois Athletic Club, Chicago.

1913

FRARY, PAUL, F.P.E., passed away on November 26, 1940 after a sudden illness. The *Engineer* extends its deepest sympathy to Mrs. Frary and his daughters, Frances, Blanche and Gertrude Ann.

LINDQUIST, JOSEPH B., Arch., resides at 1701 Mellody Road, Lake Forest, Illinois.

1914

HERITAGE, CLARK C., Ch.E., who is Technical Director, Development Dept, Wood Conversion Co., may be reached at Box 156, Cloquet, Minnesota.

1915

NAGLE, JOHN LOS, C.E., is now employed in Washington, D. C. He designed the Lincoln Memorial Bridge over the Potomac River, connecting the Lincoln Memorial and the approach to Arlington Cemetery. He is now in charge of certain phases of the design of the air bases on the areas acquired recently from Great Britain.

1916

ARMACOST, WILBUR H., M.E., who is Design Engineer, superheater and economizer division, Combustion Engineering Co., Inc., 200 Madison Ave., New York City, is now residing at 15 Popham Road, Scarsdale, N. Y.

FARRIER, CLARENCE W., Arch., is Associate Regional Coordinator, Office of Emergency Management, Division of Defense Housing Coordination, 1600 Eye St., N. W., Washington, D. C. His home is at 517 Stanley Ave., Mamaroneck, N. Y.

1917

HARVEY, JAMES D., C.E., is in business for himself under the name of James D. Harvey & Co., Real Estate Sales, Loans & Management, 10 S. La Salle Street, Chicago.

1919

MARTIN, IRL C., C.E., who is General Manager, Woodward Governor Co., 216 Mill Street, Rockford, Illinois, may be reached by R.F.D. No. 2, Rockford, Illinois.

1920

REGENSBURGER, RICHARD W., M.E., is Superintendent of the Neuhoff Packing Co., Nashville, Tennessee. His home is at 3622 Saratoga Drive, Nashville.

1921

BIRD, HARLAN W., M.E., has recently changed his address to 2233 N. Buckingham St., Lee Heights, Arlington, Virginia.

CHASE, DERWOOD SUMNER, C.E., is farming near Charlottesville, Virginia, and may be reached at Box 1313, University Station, Charlottesville, Virginia.

FASSETT, HELEN LOUISE, Arch., is Draftsman for Smith, Hinchman & Grylls, Marquette Bldg., Detroit, Michigan. She is residing at 1001 E. Jefferson St., Detroit.

ROSBACK, LEE H., C.E., is Captain in the Office of the Quartermaster General of the U. S. Army. He is stationed in Washington, D. C. His home is at 1815 Leland St., Chevy Chase, Maryland.

1922

CALLEY, FRANK W., Arch., is practicing architecture at 1519 Hinman Ave., Evanston, Illinois. This is also his home address.

GILBERTSON, GORDON A., Ch.E., resides at 1338 4th Street, Muskegon, Michigan.

RUMELY, MARK A., M.E., is Sales Agent & Representative for LaBour Co., C. B. Hunt & Son, Aurora Pump Co., Melton Roy Pumps, 24 Commerce St., Newark, New Jersey. His home is at 162 Park Avenue, East Orange, New Jersey.

1923

FUHRER, MAX, M.E., recently moved his office to Suite 1700 Burnham Bldg., 160 N. La Salle St., Chicago. He is a member of the firm, Eugene and Max Fuhrer, Architects & Engineers.

REWALDT, REINHOLD H., E.E., is Sales Engineer for Northern Indiana Public Service Co., 5265 Hohman, Hammond, Indiana. He resides at 6422 Forest Avenue, Hammond, Indiana.

1924

HARWOOD, HARLAN R., F.P.E., is living at 2521 E. Glenoaks Blvd., Glendale, California. He was recently made Underwriting Manager, Pacific Dept., Federated Hardware Mutuals, 448 S. Hill St., Los Angeles, California.

1925

BALDWIN, W. HALE, F.P.E., is Special Agent for the New York Underwriters Insurance Co., 312 Guardian Bldg., St. Paul, Minnesota. His residence is at 203 East 33rd St., Minneapolis, Minnesota.

GREENS, LOUIS S., F.P.E., was ordered to active duty as Captain in the Corps of Engineers, U. S. Army, at Camp Shelby, Mississippi, as of January 17, 1941.

WEBB, EDWARD FRANCIS, C.E., is employed on one of the National Defense Housing projects in Vallejo, California. He may be reached at P. O. Box 1112, Vallejo, California.

1926

HAMMER, HOYT MILLS, F.P.E., is residing at 2926 Feltz Ave., Cincinnati, Ohio. He is employed as Special Agent for the Fidelity & Guaranty Fire Corp., 621 Dixie Terminal Bldg., Cincinnati, Ohio.

MCLAREN, S. JOSEPH JR., F.P.E., is now in charge of engineering for Crum & Forster, Freeport, Illinois, and lives at 1568 W. Harrison St., Freeport.

MUELLER, HAROLD CHARLES, M.E., who is General Manager, The Powers Regulator Co., 2720 Greenview Ave., Chicago, is now residing at 1277 Forest Glen Dr., N., Winnetka, Illinois.

NIMOCKS, PAUL AUGUST, M.E., is Sales Manager for Container Corp. of America, 2617 W. 7th St., Fort Worth, Texas, and his home is at 2711 Greene, Fort Worth.

WERTLEY, EBERHARD E., M.E., is in business for himself as Patent Draftsman & Registered Patent Attorney, Room 1612, 53 W. Jackson Blvd., Chicago. He is now living in his new home at 7058 N. Mason Ave., Chicago.

1927

MARLOW, NICHOLAS H., M.E., is an Instructor in Machine Drawing at Schurz High School, Chicago. His wife recently presented him with a son, Paul Thomas, on March 6, 1941.

PACKARD, ROBERT W., C.E., is in the Production-Operating Dept. of R. R. Donnelley & Sons Co., 350 E. 22nd Street, Chicago. His home is at 7753 Saginaw Ave., Chicago.

PFEILER, LAWRENCE F., E.E., is now Junior Mechanical Engineer, Calumet Sewage Treatment Works, Sanitary District of Chicago, 126th St. and Cottage Grove Ave., Chicago. He was married in June, 1939, and is living in his own home at 14430 S. Michigan Ave., Riverdale, Illinois.

REUTTER, CARL J., F.P.E., who is Fire Insurance Engineer for the W. A. Alexander & Co., 135 S. La Salle St., Chicago, resides at 9909 S. Bell Ave., Chicago.

SCHULER, R. G., E.E., is Development Engineer for the Teletype Corp., 1400 Wrightwood Ave., Chicago, and lives at 337 Oakland Drive, Highland Park, Illinois.

1928

ANDERSON, LESLIE J., E.E., is Sound Engineer with the RCA Manufacturing Company. His home address is 125 North Drive, Haddonfield, New Jersey.

BATES, RICHARD H., C.E., is Division Engineer for the Standard Oil Company, Joliet, Illinois. His home is at 1323 Kenmore Ave., Joliet.

BOWMAN, IRVING H., Arch., is Architectural Draftsman, Wilbur Watson & Associates, Ravenna Ordnance Plant, Ravenna, Ohio. His home address is Box 62, Hiram, Ohio.

EVEN, JOHN T., F.P.E., is Engineer for the Fireman's Fund Group, 312 Frederick Schmidt Bldg., Cincinnati, Ohio. His home is at 5749 Doerger Lane, Cincinnati.

STEINERT, PAUL W., E.E., is employed by the Larsen Company, Green Bay, Wisconsin.

1929

AUGUSTINE, AUSTIN, F.P.E., is Special Agent for the Home Insurance Co. of New York, 116-20 S. 4th St., St. Louis, Missouri. His home is at 6853 Plymouth, University City, Missouri.

FRIEDMAN, THEODORE W., C.E., is Highway Engineer for the Public Roads Administration, Washington, D. C. His residence is at 5108 2nd St., N. W., Washington, D. C. A son, Richard W., was born October 25, 1940.

KUGLIN, CHARLES R., E.E., has recently moved to 10207 S. Wood Street, Chicago.

MISSNER, ARTHUR OTTO, C.E., who is Resident Engineer, Illinois Highway Dept. Paris, Illinois, has recently changed his address to 320 Isabella St., Wilmette, Illinois.

PHELPS, RALPH E., F.P.E., is in the Legal Department of S. S. Kresge Company, 2727 Second Avenue, Detroit, Michigan, and he resides at 739 Drexel, Dearborn.

1930

ASMUS, WILLIAM F., E.E., is a Tool Designer for the Consolidated Aircraft Company, Lindberg Field, San Diego, California. At present he is living at 3771 Eagle Street, San Diego.

FISCHMAN, LEON H., C.E., is District Engineer for the Cook County Highway Department, 160 N. LaSalle St., Chicago, and resides at 1263 Pratt Blvd., Chicago.

FISHER, FRANK J., C.E., is Cartoon Cameraman for Screen Gems, Inc., Columbia Pictures Corp., 861 N. Seward St., Hollywood, California. He resides at 914 N. Reese Place, Burbank, California.

HELLER, GEORGE J., M.E., is in business for himself as manufacturer's agent, handling air conditioning accessory equipment, P. O. Box 82, College Park Station, Detroit, Michigan. His residence is at 16559 Indiana Ave., Detroit, Michigan.

KATZ, ISADORE GORDON, Ch.E., is employed as Assistant Manager for the Edison Bros. Stores, Inc., in Kansas City, Missouri, and resides at 917 Armstrong, Kansas City.

MANSKE, WILLIAM, C.E., has moved to 820 Pennsylvania Avenue, St. Louis, Missouri. He is employed as Chief Inspector & Production Manager for American Manganese Steel Co.

SMITH, DONALD W., M.E., is Sales Engineer for the Sealed Power Corp., General Motors Bldg., Detroit, Michigan, and resides at 9240 McKinney, Detroit.

Williams, Robert R., C.E., is Assistant Civil Engineer, with the Constructing Quartermaster, Fort Sheridan, Illinois. His home address is 102 S. Butrick, Waukegan, Illinois.

1931

Abramson, Ralph J., E.E., is employed as Draftsman with the Reflector Hardware Corp., Western & 22nd Place, Chicago. His residence is at 4621 Farwell Avenue.

Atwood, Fred B., Ch.E., who is Sales Engineer, Samuel M. Langston Co., Camden, N. J., has recently moved to 653 Rector St., Roxborough, Philadelphia, Pa.

Ackers, Albert J., Ch.E., is Product Engineer for the Victor Mfg. & Gasket Co., 5750 W. Roosevelt Road, Chicago. He has completed a new home at 7157 S. California Ave., Chicago.

Dicke, Leonard H., C.E., who is Associate Engineer, War Dept., 1217 U. S. Post Office & Custom House, St. Paul, Minnesota, in the U. S. Army, still resides at 506 Mt. Curve Blvd., St. Paul.

Eddy, Richard R., F.P.E., who is Special Agent for The Home Ins. Co. of N. Y., 1047 Chamber of Commerce, Indianapolis, Indiana, resides at 5360 Guilford Ave., Indianapolis.

Erland, Edward C., F.P.E., is employed as State Agent for the Firemen's Insurance Co. of Newark, with office at 958 N. W. Bank Bldg., Minneapolis, Minnesota. His home address is 2809 Park Ave.

Iverson, Daniel J., C.E., is the proud father of a baby daughter, Helen Janet, born on September 11, 1940. He lives at 810 Michigan, Evanston, Illinois.

Johnsson, A. E. Frederick, M.E., is now Vice President in charge of production for Chicago Metal Hose Corp., 1315 S. 3rd, Maywood, Illinois. His residence is at 5751 S. Richmond, Chicago.

Morgan, Milan J., C.E., is Designing Engineer, Standard Oil Company, at Whiting, Indiana. He resides in Chesterton, Indiana.

Nelson, Raymond F., Arch., is Underwriter Assistant for the Continental Insurance Co., 844 Rush Street, Chicago.

O'Connor, Thomas B., E.E., is Schedule Maker, Chicago Surface Lines, 231 S. La Salle St., Chicago. His residence is at 6804 Perry Ave., Chicago.

Pepe, Salvatore Ernest, C.E., Associate Engineer, War Dept., U. S. Engineer Office, Binghamton, N. Y., has recently changed his address to 56 Park St., Binghamton, N. Y.

Rosen, Nathan R., Arch, is Superintendent of Construction for the Power Construction Co., 212 So. Marion St., Chicago, and lives at 823 Buena Ave., Chicago.

1932

Abramson, Paul T., Arch., is now employed by the Woodward Governor Co., Rockford, Ill.

Berger, Max, Ch.E., was married in December, 1940, and resides at 5220 Drexel Ave., Chicago. He teaches mechanical drawing and shop work at the Morrill School for Crippled Children, Chicago.

Davis, Harold R., M.E., is Cost Accountant for Wright Aeronautical Corp., Paterson, New Jersey. His residence is at 359 Prospect St., Ridgewood, N. J.

Fleishman, Maurice, Ch.E., who is Engineer with the Operadio Mfg. Co., 1 No. Crawford Ave., Chicago, has recently changed his address to 6731 S. Paxton Ave., Chicago.

Schramm, Milton E., M.E., is Research Engineer, Engine Research Laboratory, Shell Oil Co., Wood River, Illinois. He is married and has a son three years old. He is now residing at 4210 St. Louis St., Edwardsville, Illinois.

Setterberg, Harry C., C.E., who is Junior Engineer, U. S. Engineer Office, Galveston, Texas, has recently moved to 6024 Ave. Q, Route No. 1, Box 426, Galveston, Texas.

Venema, Maynard P., Ch.E., is employed with Bacon & Thomas, Attorneys, 15th & H Sts., Washington, D. C. His residence is at 8723 Second Avenue, Silver Spring, Maryland.

1933

Barnett, Orville T., Ch.E., is Engineer of Tests, Metal & Thermit Corp., 92 Bishop St., Jersey City, New Jersey. He resides at 78 James St., Westwood, New Jersey, with his wife and two sons.

Beard, Earl Gilman, Jr., C.E., who is Assistant Subway Engineer, City of Chicago, 20 N. Wacker Dr., Chicago, has recently changed his address to 501 Cumberland Ave., Park Ridge, Illinois.

Carlstrom, Roy W., F.P.E., is employed with the American Insurance Co. of Newark as Special Agent and is located at Eau Claire, Wisconsin. He recently announced the arrival of a bouncing baby boy, Terry Roy, born March 29, 1941.

Dombrow, Roman J., E.E., who is Assistant Chief Inspector, Chicago Ordnance District, U. S. War Dept., First

National Bank Bldg., Chicago, is now residing at 3858 N. Oconto Ave., Chicago. He holds a Lieutenant's rank in the Constructing Quartermaster Corps, and will be transferred to the Ordnance Reserve shortly. He also reports that he acquired an heir, Donald Roman on Dec. 23, 1940.

Nelson, Hans Peter, Arch., has been a Designer at the Westclox Company in LaSalle, Illinois, since January, 1941. A son, Richard Norman, was born to Mr. and Mrs. Nelson on November 2, 1940. They are residing at 2115 Seventh Street, Peru, Illinois.

Priban, Milton L., E.E., is employed by the Cline Electric Mfg. Co., 211 W. Wacker Drive, Chicago. His home is at 2337 S. 60th Court, Cicero, Illinois.

1934

Broockmann, Mearl Wm., F.P.E., is Inspector with the Indiana Inspection Bureau at Indianapolis, Indiana. He was married on October 15, 1938, to Miss Esther Marie Kuch. His residence is at 4246 Fairview Terrace, Indianapolis.

Gunderson, Walter E., Ch.E., who is Chemist with R. R. Donnelley & Sons Co., 350 E. 22nd St., Chicago, is now residing at 7749 S. Yates Ave., Chicago.

Kolve, I. A., M.E., is Inspector of Ordnance Material for the War Department, 309 W. Jackson Blvd., Chicago. He resides at 3247 Franklin Blvd., Chicago.

Kreuzkamp, George D., M.E., is Sales Engineer for the International Harvester Co., 180 N. Michigan Ave., Chicago. His home is at 6315 Harper Avenue.

Schmidt, Otto J., C.E., is Assistant Sanitary Engineer, Illinois Dept. of Public Health, 1800 W. Fillmore, Chicago. His home is at 3711 Greenview Avenue, Chicago.

Woodsmall, Frank J., E.E., is Assistant Electrical Engineer for the Naval Research Laboratory in Washington, D. C., and lives in his new home at 3937 First St., S. W., Washington, D. C.

1935

1935 MECHANICALS MEET

On November 13, 1940, the Mechanicals of the Class of '35 held their sixth annual fall meeting at the home of H. L. Mayerowicz. President Leroy Beckman conducted the meeting through the regular items of business and discussions of activities, including the holding of technical sessions, publication of news items concerning the group and its members, and social functions.

The terms of the offices of vice-president and secretary-treasurer had expired; Hoffman was chosen to succeed Maci as vice-president and DeBoo was reelected as secretary-treasurer.

Birdsong, John M., M.E., is working in the Marine and Aircraft section of General Electric Company, Schenectady, New York. He recently moved to 1½ Washington Avenue, Schenectady, New York.

Christoph, Albert Eldred, M.E., has returned to Chicago and is employed by the Marble-Head Lime Company. He is living at 11307 Avenue G. Chicago, Illinois.

Citro, John, Ch.E., is a Chemist for the Universal Atlas Cement Co., in Buffington, Indiana. His home is located at 312 E. 108th Street, Chicago.

Drell, Harry, M.E., has transferred to the aircraft industry on the West Coast.

Fotter, Millard Joseph, M.E., was commissioned as Lieutenant, U. S. Army, and is stationed at the Quartermaster Corps. Headquarters at Pershing Road and Wood Street, Chicago.

Freilinger, Otto P., F.P.E., is Inspector for the Kentucky Actuarial Bureau, Adams Bldg., Covington, Kentucky. He resides at 135 Tremont Ave., Ft. Thomas, Kentucky, with his wife and son.

Hahn, Armand J., Ch.E., is Assistant Director of Research, General Ice Cream Corporation, Schenectady, N. Y. His home address is 1278 Baker Avenue, Schenectady, New York.

Hella, Robert, M.E., was married to Miss Frances Jusko of Combined Locks, Wisconsin, on Feb. 8, 1941. For the past three years Hella has been working at the Combined Locks Paper Co. and he is now Superintendent of the Power Plant.

Jones Thomas France, M.E., and Mrs. Jones became the parents of a son, Bruce Allen, last summer. They live at 2831 Minnesota, S. E., Washington, D. C. He is in the Engineering Staff of the U. S. Navy.

Maci, Raymond James, M.E., is engaged in studies of vibrations in engines for aircraft at the Allison Division of General Motors Co. His home address is 3114 N. Delaware, Indianapolis, Indiana.

May, Edward Anton, M.E., has moved his business office into his new home at 2858 N. Major Avenue, Chicago. He operates the May Stoker Company.

Mayerowicz, Henry L., M.E., is now designing spray booths and equipment for the Binks Manufacturing Company, Chicago.

Messinger, Bernard L., M.E., has transferred to the aircraft industry on the West Coast.

Meyer, Fred John, M.E., is now Manager, Monacousee Division (Dry Wall Material) Bird & Son, Inc., East Walpole, Mass., and has recently changed his address to 38 Park Lane, East Walpole.

Radvilas, Charles K., M.E., is living at 3149 S. Normal Avenue, Chicago.

Sims, Stanley, M.E., now resides at 2551 W. 70th Street, Chicago.

Stanovich, Philip D., E.E., has recently changed his address to 3325 W. 61st Place, Chicago.

Vendley, Charles Edward, M.E., is making his home at 2210 Arthur Avenue, Chicago.

Wheaton, G. W., F.P.E., is Special Agent & Engineer for the Fireman's Fund Insurance Co., 878 Union Commerce Bldg., Cleveland, Ohio. His home is at 1365 Clarence Ave., Lakewood, Ohio.

Zukowski, Chester M., Arch., is Principal Engineering Draftsman, Puget Sound Navy Yard, 1148 Hewitt Street, Bremerton, Washington.

1936

Bergquist, Gustav H., C.E., is an Engineer for the Chicago Pump Co., 2300 Wolfram St., and lives at 11443 S. Central Park, Chicago.

Christenssen, Carlo M., M.E., is Engineer in charge of development & research for Harvey S. Pardee, Consulting Engineer, 200 N. Laflin St., Chicago. He resides at 836 N. Massasoit, Chicago.

Kercher, Roy S., E.Sc., is employed at Underwriters Laboratories, Inc., 207 E. Ohio St., and resides at 23 W. Franklin, Naperville, Ohio. He and his wife are proud to announce the arrival of a baby girl, Phyllis, on March 25, 1941.

Kropi, Victor James, E.E., was married to Miss Jane Averman of Pittsburgh on April 12, 1941.

LaPedis, William Edward, M.E., who is an Engineer for the Adams Machinery Company in Chicago, resides at 2822 Arthur Ave., Chicago.

Neal, Donald J., F.P.E., is Special Agent for the National Fire Insurance Co. of Hartford, 857 Leader Bldg., Cleveland, Ohio. His home is at 855 Roanoke Road, Cleveland Heights, Ohio.

Rundell, William G., M.E., is employed as Field Engineer for the Air Conditioning & Commercial Refrigeration Dept. of General Electric Co., 5 Lawrence St., Bloomfield, New Jersey. His residence is at 165 Franklin St., Bloomfield, New Jersey.

Siegel, Louis, Ch.E., is now Procurement Supervisor, Joseph E. Seagram & Sons, Inc., Louisville, Kentucky. He resides at 1625 S. Third St., Louisville.

STERN, HARRY M., C.E., is Manager of the Miami Cigar & Tobacco Co., 109 E. 5th St., Dayton, Ohio. He resides at 655 Superior St., Dayton, Ohio.

TALLAESS, W. J., Ch.E., is employed at the Bendix Aviation Corporation, South Bend, Indiana. His home address is 1319 E. Victoria St., South Bend, Indiana.

1937

BECKMAN, MORRIS H., Arch., is employed by James Crabb, Builder, 1225 Central Ave., Wilmette, Illinois. He lives at 6130 N. Paulina St., Chicago.

BREUER, ROLF O., E.E., has been made Cost Engineer for Atkinson and Pollock, who are contractors for U. S. Fleet Operating Base at Terminal Island. He is residing at 210 East Third St., Long Beach, California.

HARROLD, R. J., M.E., is Supt. of Inspection for the Charles Bruning Co., Inc., 1131 W. Hubbard St., Chicago. His residence is at 1930 W. Quincy Street, Chicago. A baby daughter, Sandra Joan, was born August 7, 1940.

HEISE, BERTRAM F., E.E., is Auxiliary Operator, Commonwealth Edison Co., Northwest Station, Roscoe & California Aves., Chicago. He resides at 1137 School Street, Chicago, with his wife and daughter.

JANAS, LEO J., M.E., is Plant Industrial Engineer, Illinois Tool Works, 1001 S. Grace St., Elgin, Illinois. He may be reached at 1210 W. Erie St., Chicago.

KACH, LOUIS FREDERICK, Ch.E., is now Asst. Plant Manager, Jos. E. Seagram & Sons, Inc., Louisville, Ky.

KICHAVEN, JOSEPH, Arch., is Junior Architectural Engineer, War Dept., Office of Chief of Engineers, Washington, D. C., and lives at 1337 Perry Pl., N. W., Washington, D. C.

KRAFT, LOUIS GEO., E.E., is employed as Coil Expert by the Carron Mfg. Co., 107 S. Aberdeen Street, Chicago. At present he lives at 15621 S. Marshfield Ave., Harvey, Illinois.

KUBERT, JOSEPH M., E.E., is Consulting Engineer with Booz, Fry, Allen & Hamilton, 135 S. LaSalle St., Chicago. He is engaged on an organization and personnel problem in connection with a new ammunition plant being erected in St. Louis. He recently changed his address to 1827 N. Fairfield Ave., Chicago.

LEVY, ROBERT M., Ch.E., is employed by Ecusta Paper Corp., Pisgah Forest, North Carolina, and may be reached at P. O. Box 162, Brevard, N. C.

LOWRY, ROBERT K., M.E., is Plant Engineer for the U. S. Gypsum Co., Falls Village, Connecticut. He may be reached at Box 85, Canaan, Connecticut.

MCCARTY, CARROLL J., C.E., is a Research Fellow, Bureau for Street Traffic Research, Yale University, New Haven, Connecticut, where he will be until June 1, 1941. His home address is 5710 W. Ohio Street, Chicago.

POPPER, FRANCIS XAVIER, C.E., is an Aid in the United States Coast and Geodetic Survey, U. S. S. Guide, P. O. 1197, Oakland, California.

SKACH, FRANK J., M.E., is Weight Control Engineer for the Beech Aircraft Corporation, Wichita, Kansas. His home address is 131 S. Bleckley Drive, Wichita, Kansas. He was married on August 24, 1940, to Miss Anita L. Buser of Wichita, Kansas.

WESTERMAN, FRANCIS G., F.P.E., is employed by Lansing B. Warner, Inc., Merchandise Mart, Chicago. He was married in October, 1940, and is residing at 1218 W. 87th St., Chicago.

WILHELM, W. B., Ch.E., is Junior Inspector of Engineering Materials, Navy Dept., 1600 Arch St., Philadelphia, Pennsylvania. He is at present working at Triumph Explosives, Inc., Elkton, Maryland. His home is in Monkton, Md.

1938

CHILGREN, WILLIAM JUDD, M.E., is General Foreman for the Remington Arms Co., Inc., in Bridgeport, Connecticut. Residence is at 2886 Nichols Ave., Nichols, Connecticut.

LUBER, MORTON EUGENE, Ch.E., is Engineer for the Indiana Inspection Bureau, Citizens Trust Bldg., Fort Wayne, Indiana. He resides at the Y. M. C. A., Fort Wayne.

MONSON, RONALD, C.E., can be reached at 115 34th Street, Newport News, Virginia.

MOORE, ROBERT EARL, E.E., is Owner of a wholesale paper business located at 3412 S. Justine Street, Chicago. He has built his own home at 9806 S. Lawndale Ave., Evergreen Park, Illinois.

PALKA, GEORGE A., E.E., who is employed with the Standard Transformer Co., Warren, Ohio, resides at 950 Dana St., Warren, Ohio. He was married in November, 1940, to Miss Winifred Edmiston of Maywood, Illinois.

RODKIN, DAVID B., M.E., is now working in the Production Dept., Seattle-Tacoma Shipbuilding Corporation, Tacoma, Washington. He may be reached at P. O. Box 822, Tacoma, Washington.

THODOS, GEORGE, Ch.E., of 5323 Congress Street, Chicago, was granted the McMullen Graduate Scholarship in Chemical Engineering for the academic year 1941-1942 at Cornell University.

1939

ANDERSON, BOLTON G., F.P.E., is in training at Camp Shelby, Hattiesburg, Mississippi.

BAIN, LEWIS A., JR., Ch.E., who is an engineer in the Development Dept., Wood Conversion Co., was married in July, 1940. His residence is at 109 Avenue "D," Cloquet, Minnesota.

COYLE, ROBERT H., M.E., is Inspector for the Navy in a Curtiss Wright Plant, and may be reached c/o Joe Zeir, Robertson, Missouri.

DEMPSEY, ARTHUR J., M.E., is employed as Test Engineer, Research Dept., Continental Aviation & Engineering Corp., 12801 E. Jefferson St., Detroit, Michigan. His home is at 1116 Iroquois, Detroit.

EVANOFF, STEPHEN, JR., Ch.E., is employed as Chemical Engineer for the Burgess Battery Co., 500 W. Huron St., Chicago. He was recently married to Miss Anne Vocelka of Berwyn, Illinois, and they are living at 1155 S. Mason Avenue, Chicago.

FOOHLIK, IRVING, M.E., is employed as Junior Engineer in the War Dept., Air Corps Material Division, Wright Field, Dayton, Ohio. He lives at 1321 Superior Avenue, Dayton, Ohio.

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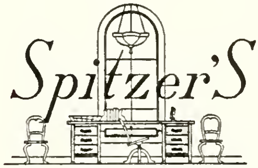

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REPAIRS PROMPTLY DONE

Johannsson, Ernst Eric, M.E., is Sales Engineer for H. B. Johnson, 549 W. Washington Blvd., Chicago, and lives at 1920 N. Talman Ave., Chicago.

Kroll, Stephen E., M.E., is doing design work for the Goodyear Aircraft Co., Akron, Ohio. He resides at 73 Rhodes Ave., Akron.

Lozins, Neal Gilmore, M.E., was married on April 4, 1941, to Miss Bernadine Alberta Davis. He is residing at 5746 Colorado Avenue, N. W., Washington, D. C.

Neubauer, Fred William, C.E., is Topographic Surveyor, U. S. Army, Company "D," 30th Engineers, Fort Belvoir, Virginia. He may be reached at 1415 Rascher Ave., Chicago.

Ed. Swanson, '39

Swanson, Edward R., F.P.E., is now a Naval Air Corps Cadet at the Navy Air Station, Pensacola, Florida. For mail: 7411 Rhodes Avenue, Chicago.

Van Alsberg, Earl R., M.E., is employed by the Consolidated Aircraft Corporation in San Diego, California. He may be reached at 1107 Twenty-eighth St., San Diego.

Williams, Robert M., Sc., is residing at 7836 Prairie Avenue, Chicago.

1940

Blume, Leroy O., M.E., is now in the army and is stationed at Fort Sill, Oklahoma.

Cambras, Marvin, E.E., who is Electrical Engineer for the Armour Research Foundation, 35 W. 33rd Street, is now living at 1418 S. Karlov Ave., Chicago.

Charleton, J. Donald, Ch.E., may be reached at Box 158, Cary Hall, W. Lafayette, Indiana. He has been appointed counselor of a men's dormitory on the Purdue Campus.

Collopy, Robert J., Ch.E., is employed as Chemist for Lever Brothers Co., Hammond, Indiana, and lives at 212 N. Kenneth Ave., Chicago.

Eggers, John G., F.P.E., who is Inspector Kentucky Actuarial Bureau, 940 Starks Bldg., Louisville, Ky., has recently moved to Apt. 1. 2, Green Tree Manor, Louisville, Ky.

Frost, George E., E.E., is now Test Engineer for the General Electric Company, in Schenectady, New York.

Hansen, Arthur G., M.E., writes the following interesting letter to the Alumni Editor from Camp Wallace, Hitchcock, Texas, under date of March 23, 1941:

Greetings:

Well, here I am, a long way from good old Armour (or Illinois Tech., if you want to be formal), and like a lot of others of my classmates of 1940, far from home.

Until early in March, I was employed by the Chicago Board of Underwriters, being a fire insurance rater and inspector of the Loop territory in Chicago. Then came the draft, and as I was one of the lucky boys with low local board numbers (356) I was taken in by Selective Service.

Boy, talk about the rosy pictures they print of the Army. Well, when we get up (5:30 A. M.) the sky isn't even rosy. Morning chow at 6:00 A. M., morning drills, lessons, and work until 11:30. Noon chow is served at 12:00; the afternoon program (similar to mornings) runs from 1:00 to 4:30. Evening chow is at 5:00. From then on we are free to do with as we please until 9:00 P. M., when lights go out in the barracks. Taps (everyone in bed) are sounded at 11:00. In two weeks in the Army I haven't stayed up past 9:30 P. M. yet. Gad, what a change! Since we are all under quarantine at present, we have even forgotten what women look like.

Our training unit is a coast artillery (anti-aircraft) battalion, as are the other battalions in this camp.

Any members of the class of '40 (especially the Mechs) and fellows from other classes can reach me by letter up until the middle of June by the address below.

Sincerely,
Pvt. Arthur G. Hansen,
Btry A, 28 C. A. Tng. Bn.,
Camp Wallace, Texas.

P. S. After May 1st, 1941, my *home* address will be 5254 Grove St., Skokie, Ill.

Kreydich, W., E.E., is Testing Engineer for the Kellogg Switchboard & Supply Co., 6600 S. Cicero Ave., and is living at 12527 S. Marshfield Avenue, Chicago.

Mashinster, Wm. H., M.E., who is Research Engineer, Standard Oil Co., Whiting, Indiana, has moved to 7511 Cornell Ave., Chicago.

Maxwell, Robert B., Jr., F.P.E., is Inspector for the Missouri Inspection Bureau, 1201 Gloyd Building, Kansas City, Missouri, and lives at 101 E. Armour Blvd., Kansas City.

Nader, Frank Albert, Jr., E.E., is employed by the R. C. A. Manufacturing Co., 501 N. LaSalle Street, Indianapolis, Indiana. He is living at 5219 E. St. Joseph Street, Indianapolis, Indiana.

Sternfeld, Bernard, M.E., has recently moved to 613 Park Avenue, East Orange, New Jersey.

1941

Ahlstromer, Magnus John, Jr., M.E., Chicago Screw Co., 1026 S. Homan St., Chicago. Home: 1625 Grace St., Chicago.

Anderson, Guveren Montgomery, M.E. Crowe Name Plate and Mfg. Co., 3701 N. Ravenswood, Chicago. Home: 1322 Dayton St., Chicago.

Anthony, William Roy, Jr., M.E. The Hallicrafters Inc., 2611 S. Indiana Ave., Chicago. Home: 2323 Melrose St., Chicago.

Appelt, Leonard, M.E. Western Electric Co., Cicero, Illinois. Home: 1548 S. Rockwell, Chicago.

Beckmann, Paul G., M.E. Republic Steel Corp., 11800 S. Burly St., Chicago. Home: 7630 Vernon Ave., Chicago.

Blaida, Andrew Stanley, M.E. Danly Machine Specialties Inc., 2104 S. 52nd St., Cicero, Illinois. Home: 4725 Florence St., Downers Grove, Illinois.

Burkland, Roy Harold, M.E. Appleton Electric, 1713 W. Wellington, Chicago. Home: 3219 N. Racine, Chicago.

Chlubinski, Gilbert Severyn, M.E. Danly Machine Specialties Inc., 2104 S. 52nd St., Cicero, Illinois. Home: 2841 Spaulding Ave., Chicago.

Colantonio, Arnold M., M.E. Howe Ice Machine Co., 2825 W. Montrose Ave., Chicago. Home: 5002 Armitage Ave., Chicago.

Connors, Edward C., M.E. Home: 1850 Quincy, Chicago.

Ender, Joseph Jack, M.E. Universal Clamp Co., 972 W. Montana St., Chicago. Home: 1545 S. Tripp Ave., Chicago.

Gaderlund, Harry A., M.E. Foote Bros. Gear and Machine Corp., 5301 S. Western Ave., Chicago. Home: 4911 N. Hoyne, Chicago.

Garvey, Henry M., M.E. The Pyle National Co., 1334 N. Kostner St., Chicago. Home: 3328 W. 65th Pl., Chicago.

Gustavson, Harold P., M.E. Home: 1333 Chestnut St., Western Springs, Illinois.

Hawkins, Milton G., M.E. Danly Machine Specialties, Inc., 2104 S. 52nd St., Cicero, Illinois. Home: 205 S. Washington, Westmont, Illinois.

Heidenreich, Frank John, Jr., M.E. Mills Novelty Co., 4110 W. Fullerton, Chicago. Home: 6 W. Burlington St., Box 17, Clarendon Hills, Illinois.

Hering, Harold Edward, M.E. Michle Printing Press & Mfg. Co., W. 14th St. & S. Damen Ave., Chicago. Home: 2715 W. 23rd Pl., Chicago.

Hill, Charles Frederick, M.E. Goodman Mfg. Co., 4834 S. Halsted St., Chicago. Home: 10616 Avenue F., Chicago.

Hill, John G., Jr., M.E. Shure Brothers, 225 W. Huron St., Chicago. Home 6925 Ottawa Ave., Chicago.

Hollowich, Garrison G., M.E. Illinois Tool Works, 2501 N. Keeler Ave., Chicago. Home: 3220 W. Leland Ave., Chicago.

Hutchings, Warren, M.E. Foote Bros. Gear and Machine Corp., 5301 S. Western Ave., Chicago. Home: 4315 Van Buren St., Chicago.

Johnson, Birger E., M.E. Delta-Star Electric Co., 2437 W. Fulton Ave., Chicago. Home: 1107 N. Leamington, Chicago.

Johnson, Robert Nevin, M.E. Union Special Machine Co., 400 N. Franklin St., Chicago. Home: 1024 Country Club Rd., Joliet, Illinois.

Johnson, Wallace A., M.E. Home 1822 Juneway Terrace, Chicago.

Jonis, Donald J., M.E. Farrell Mfg. Co., Joliet, Illinois. Home: 356 Whittier Ave., Joliet, Illinois.

Kallevik, Benjamin E., M.E. All Steel Equipment Co., Inc., Aurora, Illinois. Home: 1021 S. 4th St., Aurora, Illinois.

Kasper, Louis Ray, E.E. Home: 205 E. 82nd St., Chicago.

Kleinwachter, Kenneth James, M.E. Home: 7715 Crenshaw Blvd., Los Angeles, California.

Kosley, Raymond W., M.E. Western Electric Co., S. Cicero & W. Cermak Rd., Cicero, Illinois. Home: 1522 N. Mayfield, Chicago.

Krahulec, Fred, M.E. Trimm Radio Mfg. Co., 1770 W. Berteau Ave., Chicago. Home: 2507 Ridgeland Ave., Chicago.

Krantz, Herman Frank, M.E. Lyon

Metal Products, Aurora, Illinois. Home: 807 Aurora Avenue, Aurora.

KRUSE, HAROLD NORMAN, M.E. Great Lakes Forge Co., 1220 W. 119th St., Chicago. Home: 10853 Vernon Ave., Chicago.

KUCERA, JOHN J., JR., M.E. Union Special Machine Co., 400 N. Franklin St., Chicago. Home: 2750 S. Homan Ave., Chicago.

KUIJEKE, FREDERICK C., JR., M.E. American Steel Foundries, 410 N. Michigan Ave., Chicago. Home: 5838 N. Kostner Ave., Chicago.

KURLAND, JEROME J., C.E. Home: 1608 Millard Ave., Chicago.

LARINOFF, MICHAEL W., M.E. The Buda Co., 154th St., Harvey, Illinois. Home: 15266 Walton Ave., Harvey.

LAVOLD, GERALD, M.E. Illinois Tool Co., 2501 N. Keeler Ave., Chicago. Home: 3305 W. Diversey Blvd., Chicago.

LEVERENZ, ERNEST G., M.E. American Steel Foundries, 410 N. Michigan Ave., Chicago. Home: 3119 N. Kilbourn Ave., Chicago.

MCKEON, THOMAS F., M.E. Container Corporation of America, 1301 W. 35th St., Chicago. Home: 7643 Drexel Ave., Chicago.

MAERTIN, HARVEY A., JR., M.E. Mojonnier Brothers Co., 3601 W. Ohio St., Chicago. Home: 5341 S. Hoyne Ave., Chicago.

MAZE, LOUIS, E.E. Home: 1659 Washburne Ave., Chicago.

MEYERS, STANFORD WALTER, JR., M.E. Chicago Screw Co., 1026 S. Homan St., Chicago. Home: 2413 Leland Ave., Chicago.

MONSON, DONALD, Arch. Home: 4926 Kimbark Ave., Chicago.

NELSON, BERTEL S., M.E. Foote Bros. Gear and Machine Corp., 5301 S. Western Ave., Chicago. Home: 1433 N. Kolin, Chicago.

NIGRELLI, BIAGIO J., M.E. Delta-Star Electric Co., 2437 W. Fulton Ave., Chicago. Home: 2921 S. Wallace St., Chicago.

OLINGER, DONALD RICHARD, M.E. Chicago Screw Co., 1026 S. Homan St., Chicago.

OLSEN, STUART T., M.E. Goodman Mfg. Co., 4834 S. Halsted St., Chicago. Home: 221 N. Lockwood, Chicago.

PARKER, GEORGE H., M.E. Container Corporation of America, 1301 W. 35th St., Chicago. Home: 4228 Washington Blvd., Chicago.

PARKER, VERNON HALDON, M.E. All Steel Equipment Co., 326 S. Jefferson, Chicago. Home: 802 Hinman St., Aurora, Illinois.

PAVEL, HAROLD J., C.E. Home: 2301 S. Homan Ave., Chicago.

PLOWMAN, JAMES WILSON, FPE. Home: 958 E. 40th St., Chicago.

RADVILLAS, STANLEY G., M.E., Goodman Mfg. Co., 4834 S. Halsted St., Chicago. Home: 3149 S. Normal Ave., Chicago.

RIESER, DOUGLAS ALOIS, C.E. Home: 628 Fox St., Aurora, Illinois.

RUHL, EDWARD W., M.E. American Manganese Steel Co., 389 East 14th St., Chicago Heights, Illinois. Home: 1227 Sunnyside Ave., Chicago Heights.

SCHMAL, RALPH J., M.E. American Steel Foundries, 4831 Hohman St., Hammond, Indiana. Home: 29 Carroll St., Hammond.

SCHMIDT, EDWARD W., M.E. American Steel Foundries, 4831 Hohman St., Hammond, Indiana. Home: 923 Michigan St., Hammond.

SCHMIDT, ROBERT F., M.E. Lyon Metal Products, Inc., 605 W. Washington St., Chicago. Home: 119 Warren Ave., Aurora, Illinois.

SCHOFFEMAN, LAWRENCE G., M.E. Crowe Name Plate and Mfg. Co., 3701 N. Ravenswood, Chicago. Home: 3812 N. Oakley Ave., Chicago.

SMITH, LEON L., M.E. Home: 3563 W. 5th Ave., Chicago.

SWEITZER, JOHN H., M.E. Container Corporation of America, 905 N. May St., Chicago. Home: 629 N. Stone, La Grange, Illinois.

WHITTINGHAM, DAVID J., M.E. American Steel Foundries, 410 N. Michigan Ave., Chicago. Home: 5456 Ferdinand St., Chicago.

WIERZBICKI, EDWARD J., M.E. American Steel Foundries, 4831 Hohman St., Hammond, Indiana. Home: 5417 S. Seeley Ave., Chicago.

WILMS, CARL A., M.E. W. D. Allen Mfg. Co., 566 W. Lake St., Chicago. Home: 1623 Kedvale St., Chicago.

WOGNUM, JAMES N., M.E. Acme Steel Co., 134th & Clark Sts., Riverdale, Illinois. Home: 10157 Lowe Ave., Chicago.

WOODS, PETER H., M.E. Link-Belt Co., 307 N. Michigan Ave., Chicago. Home: 1144 Woodrow St., Lombard, Illinois.

ZALEWA, STANLEY F., JR., M.E. Link-Belt Co., 300 W. Pershing Blvd., Chicago. Home: 4933 W. 12th St., Cicero, Illinois.

ZYWOT, WALTER, M.E. American Steel Foundries, 4831 Hohman St., Hammond, Indiana. Home: 586 Price St., Calumet City, Illinois.

PHOTOELASTIC ANALYSIS

(From page 13)

further discussion of this important matter. The following references are offered:

"Correlation Between Metallography and Mechanical Testing," H. F. Moore, Reprint No. 9, University of Illinois Engineering Experiment Station.

"Methods of Correlating Data from Fatigue Tests of Stress Concentration Specimens," R. E. Peterson, Timoshenko 60th Anniversary Volume.

Letter by the writer to MACHINE DESIGN, Professional Viewpoints Section, August, 1940.

It has been the intention of this paper to bring to the design engineer an appreciation for the commercial value of the application of photoelastic analysis, and a realization of the simplicity of its application. The writer recommends that a careful investigation be made in each individual case to determine the value of equipping the engineering department with photoelastic apparatus.

Acknowledgment to MACHINE DESIGN is made for permission to use the cuts of Figs. 3 to 9 inclusive and Fig. 12.

CHICAGO'S BRIDGES

(From page 23)

deteriorated, necessitated extensive reinforcements and renewal of component parts.

Many different types of bridge floors have been used since 1890. Considerable study has been given this subject. For observation purposes and to clarify differences of opinion as to the efficiency of various types of construction, typical bridge pavements were installed on the south roadway of Lake Street bridge in 1930, establishing a sort of "roadway laboratory". Of about fifteen types of construction and wearing surfaces, a few proved unsatisfactory. In other samples, weight, cost, wearing qualities, or maintenance costs were factors against them, with the result that today only six different types of bridge pavement are used, the specific type depending on the particular problem at hand.

For example, in 1939 it became necessary to redeck the upper level of the Michigan Avenue bridge to replace a worn rubber-tile pavement installed in 1927. This bridge is a two-level structure with the lower level accommodating trucks, while the upper level serves boulevard and bus traffic. This construction establishes a distance of twenty-one feet from the trunnion to the upper roadway level. Material change in weights of this decking would necessitate a large amount of additional counterweight to prevent the bridge from "falling backwards" when the bridge was raised and to otherwise maintain the horizontal and vertical moment balance. Consequently a comparatively light deck of timber and asphalt planking was adhered to with aluminum curbs and center strip. Back of the trunnions a combination wearing-surface of cast iron and concrete $1\frac{1}{2}''$ thick was provided, mainly for added stopping and traction advantages to autos.

In this instance, due to the lower-level traffic, the upper deck had to be waterproofed. With the wear of 40,000 autos and busses daily on this upper level some idea of a few of the elements entering into bridge-floor design are brought to light.

In the maintenance and operation of this bridge system, damages to various parts of the structure and its equipment may result from collisions with vehicles. The more serious of these is from collision of large steamboats with the movable leaves or the foundations of the bridge. In the instance of the sandboat collision with the old Clark Street swing bridge, this was of such a serious nature as to require removal of the old bridge, but ordinarily repairs can be made. These repairs are generally made under difficult conditions in that it is essential

to keep traffic going over the structure while repairs are in progress and also to keep the bridge in operating condition so as not to impede vessel movements.

With apologies for this personal reference, the writer as a native Chicagoan recalls the bridges of the early nineties over which nearly every crossing was a precarious one. In his connection with the Bridge Division since 1913 it has been his privilege to be closely associated with the engineers and the many skilled mechanics who put forth tremendous mental and physical efforts, and in many cases gave their lives in the endeavor, which carried the development of these structures from the frail structures of the early nineties to those of the present. Space does not permit naming the many city officials, civic bodies and others who cooperated with the engineer in the solution and coordination of the political and economic problems.

In closing we feel that some parts of this story might well be omitted, rather than not to include a word of tribute to two men, the late Alexander von Babo, Engineer of Bridge Design, and Thomas G. Pihlfeldt, Engineer of Bridges, who passed on recently after more than fifty years in this service and under whose direction the bridge system of Chicago attained its position as one of the world's great achievements.

This article is submitted with the approval of Oscar E. Hewitt, Commissioner of Public Works; W. W. DeBerard, City Engineer; and S. J. Michuda, Engineer of Bridges.

CO-OPS

(From page 30)

tries are interested in directing their students toward this field, which may mean the directing of human beings rather than the engineering of materials.

The success indicated above is not universal. There have been difficulties in carrying the program forward. One company spent time and energy trying to hire other engineering graduates, although they had four co-operative students about to graduate from their own plants. Although their attention had been called to these men, they lost them to other companies which were quick to take the men that the original employer was too busy to follow up. Another company expected the co-operative students to work five years at the starting wage. Still another would grant a two-cent-an-hour raise if the students kicked hard enough. One works manager, although he had received reports of the students' grades at the end of each college term, never talked to students during their five years in his plant.

Some student problems have been interesting. A student after six months experience asked for a transfer to another company because he had learned all there was to know with the first company. Another pair after two months in a stock room in which some fifty thousand different parts were kept wanted to be transferred to a place where they could learn something.

Many calls have come to the Armour College of Engineering for students to work in industries outside the Chicago area. Many of the companies co-operating select from the apprentices in their own plant those who were high-ranking students in high school and who show unusual ability. Still other companies ask for Chicago students to work outside of Chicago.

All candidates are given a battery of tests before being accepted by the college and are required to be in the upper quarter of their high school class.

TABLE II

Dept.	*Location*	*Time Spent in Dept.*	*Time Spent In School*	*Wages*
—	School		2 months	Starting wage 45c
38	Tool Grinding	1 month		
18	Inspection	1 month		
—	School		2 months	
34	Layout	1 month		
30	Welding	1 month		
—	School		2 months	
9	Gear Cutting	2 months		2nd year 50c
				3rd year 55c
				4th year 60c
39	Stock Room	1 month		
49	Tracing	1 month	2 months	
—	School			
49	Shop Engineering	2 months	2 months	5th year 65c
—	School			
49	Shop Engineering	2 months		
—	School	2 months	2 months	
49	Shop Engineering			

BEHIND DEFENSE

(From page 26)

duties of this unique institution, to keep the whole machine operating smoothly with no stops or breakdowns, requires a staff of no less than seventy-seven persons, including trained librarians, clerks, stenographers, typists, printers, book binders, engineers, janitors and pages.

While books and libraries are being burned and destroyed in Europe, in America we still have the freedom to enjoy unmolested one of the most democratic of institutions—the free public library. Sensing our strength and knowing our value, we feel grateful for the privilege of serving to build a constructive defense as opposed to the useless vocal vituperations so common in many quarters today.

BETTER MOUSETRAPS

(From page 32)

room was called into play. An inner glass-walled room was erected and fitted with auxiliary blowers as well as a liquid-air evaporator. Full dressed for a jump, the parachutist stepped into the chamber and faced a wind of 200 miles per hour at 67° below zero, while tests were made to assure the safety of each article of apparel and the functioning of each piece of equipment carried. Had anything been defective, the parachutist could have stepped out of danger at once, a feat somewhat more difficult when one is dropping through empty air on a one-way ticket.

FRANCIS W. GODWIN,
Armour Research Foundation.

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LOOKING TO THE FUTURE - - -

In many branches of industry today the demands of the national defense program are taxing production facilities to the limit. For the moment, there seems to be little need for industry to press its search for new markets for its products: its problem is rather to find ways of satisfying the urgent needs of its present customers. Nor does the necessity for developing new products or improving existing ones seem as urgent as usual. In fact, in many branches of industry, it may be desirable to "freeze" existing designs in order to maintain uninterrupted production and utilize capacity to best advantage.

Yet these factors do not decrease the importance of prosecuting, with unabated vigor, a consistent program of long-term research to develop new products and uncover new markets: they serve rather to emphasize the vital necessity of such a policy. Far-sighted industrial executives fully recognize that the conditions existing today are necessarily temporary and that a slackening of the demand for industry's products in the future will initiate an era of exceptionally keen competition to maintain sales volume in a contracting market. A long range program of research and development is of invaluable assistance in preparing to meet the conditions that will confront industry in the future. By paving the way for increasing sales volume by entering new markets or introducing new products it will serve to counterbalance influences that might otherwise adversely affect industrial progress and development.

Though industrial executives clearly recognize the wisdom of continuing or expanding their research programs, they may find it difficult, under current conditions, to carry on their research activities without interruption. In many industries research facilities, like production facilities, are being taxed to their full capacity in dealing with emergency problems. The expansion of research facilities to assure continuation of long-term programs is a costly, time-consuming task—and one that may not be justified by a company's normal requirements for research activity.

Under these circumstances, the advantages of an isolated laboratory, such as the Armour Research Foundation, become especially noteworthy. The Armour Research Foundation offers industry an effective way of supplementing existing research facilities, and of carrying on long-term projects without interruptions caused by production emergencies. Skilled research workers are specifically assigned to individual projects, which they can efficiently carry on to completion. By utilizing the facilities of the Foundation, a manufacturer is enabled to devote more of the time of his own research staff to the specific production problems that are arising today—and still continue his long-range program, without incurring the disproportionate expense that would be involved in the construction of additional facilities in his own plant.

—from THE FRONTIER, March, 1941

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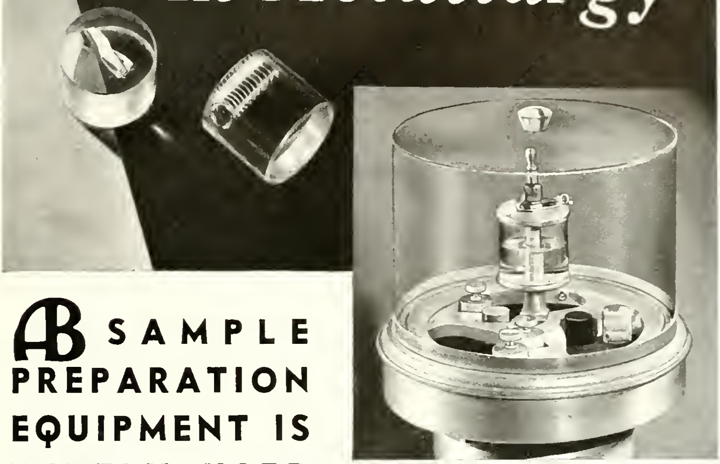

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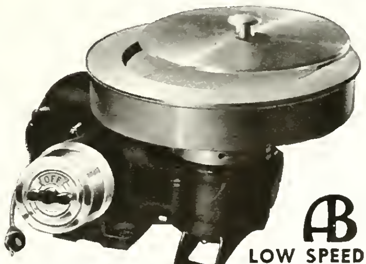

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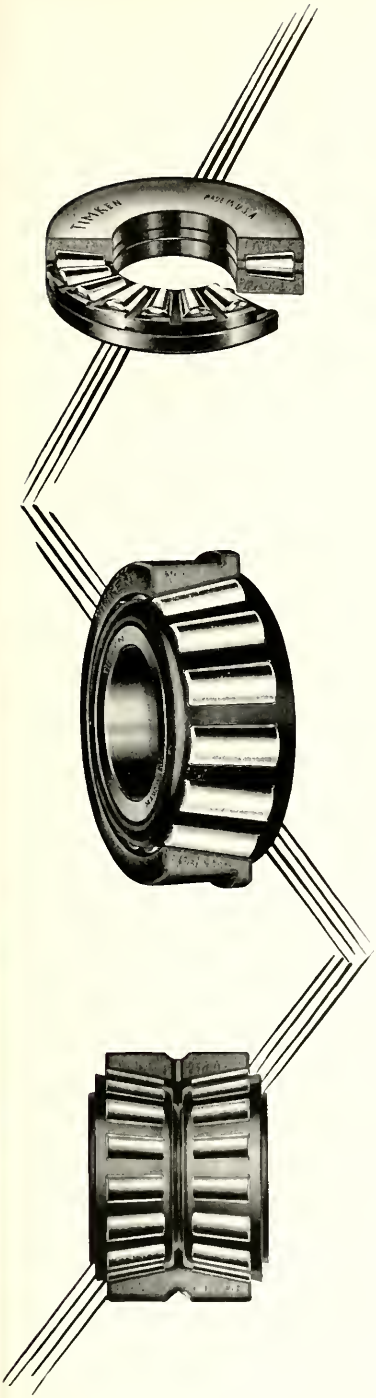

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